FINAL REPORT

Carlsbad
Municipal Water District

2012
RECYCLED WATER
Master Plan

carollo
Engineers...Working Wonders With Water®

CH2MHILL

Engineers...Working Wonders With Water™

January 12, 2012
8308A00

Carlsbad Municipal Water District
1635 Faraday Avenue
Carlsbad, CA 92008

Attention: Mr. David Ahles, P.E.

Subject: Recycled Water Master Plan

Dear Mr. Ahles:

We are pleased to present the final Recycled Water Master Plan (RWMP) to you and the Carlsbad Municipal Water District (CMWD) staff. Enclosed are 5 copies of the RWMP report for your use.

We want to thank you for the opportunity to work with you on this interesting project. We have enjoyed working with you and everyone else of the CMWD staff involved during this project. We look forward to opportunities to work together again in the future. Please feel free to contact us if you have any questions or if we can be of any further assistance.

Sincerely,

CAROLLO ENGINEERS, INC.

Inge Wiersema, P.E.
Project Manager

Enclosures: Final Report of the RWMP
CD with report and model files

199 South Los Robles, Suite 530, Pasadena California 91101
P. 626.535.0180 F. 626.535.0185
carollo.com

City of Carlsbad

RECYCLED WATER MASTER PLAN

January 2012

199 SOUTH LOS ROBLES AVENUE • SUITE 530 • PASADENA, CALIFORNIA 91101 • (626) 535-0180 • FAX (626) 535-0185

This page intentionally left blank.

City of Carlsbad

Recycled Water Master Plan

TABLE OF CONTENTS

Page No.

CHAPTER 6: HYDRAULIC MODEL

CHAPTER 7: PLANNING AND EVALUATION CRITERIA

CHAPTER 8: EXISTING SYSTEM EVALUATION

CHAPTER 9: FUTURE SYSTEM EVALUATION

CHAPTER 10: CAPITAL IMPROVEMENT PROGRAM

LIST OF APPENDICES

LIST OF TABLES

Page No.

LIST OF FIGURES

Page No.

LIST OF ABBREVIATIONS

Abbreviation	Description
AACE	Association for the Advancement of Cost Engineering
AAD	Average Annual Demand
ACP	Asbestos Cement Pipeline
ADD	Average Day Demand
af	Acre Feet
afy	Acre Feet per Year
AL	Action Level
AWWA	American Water Works Association
BSD	Buena Sanitation District
Carollo	Carollo Engineers
CCB	Chlorine Contact Basin
CCR	California Code of Regulations
CCL3	Contaminant Candidate List 3 (third version)
CDPH	California Department of Public Health
CEC	Constituents of Emerging Concern
CIP	Capital Improvement Program
City	City of Carlsbad
CML&C	Cement mortar lined and coated steel
CMWD	Carlsbad Municipal Water District
COO	City of Oceanside
CWC	California Water Code
CWRF	Carlsbad Water Recycling Facility
DDT	Dichloro-Diphenyl-Trichloroethane
DEH	Department of Environmental Health
DIP	Ductile Iron Pipeline
District	Carlsbad Municipal Water District
DPH	Department of Public Health
DPS	Department of Public Safety
DWR	Department of Water Resources
EDC	Endocrine Disrupting Compounds
ENR	Engineering News Record
EOO	Encina Ocean Outfall
EPA	Environmental Protection Agency
EPS	Extended Period Simulation
EWPCF	Encina Water Pollution Control Facility
ET	Evapotranspiration
EWA	Encina Wastewater Authority
FCV	Flow control valve
ft	Feet
ft/kft	Feet per thousand feet
ft-msl	Feet above mean sea level
ft/s	Feet per second

Abbreviation	Description
gal	Gallon
GIS	Geographic Information System
gpd/ac	Gallons per day per acre
gpm	Gallons per minute
GWRP	Gafner Water Reclamation Plant
H_2OMAP Water	Hydraulic Modeling software package from MWH Soft, Inc.
HCF	Hundred cubic feet
HDPE	High density polyethylene
HGL	Hydraulic Grade Line
HOA	Home Owners Association
hp	Horsepower
HPT	Hydro-pneumatic Tank
HSA	Hydrological Sub Area
HT	Hydro-pneumatic Tank
HU	Hydrological Unit
HWL	High Water Line
I-5	Interstate 5
in	Inches
kWh	Kilowatt-hour
LRP	Local Resources Program
LWWD	Leucadia Wastewater District
MBR	Membrane Bioreactor
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
MF	Micro Filtration
MF	Multiple Family
MG	Million Gallon
mgd	Million gallons per day
mg/L	Milligrams per liter
MinDD	Minimum Day Demand
MMD	Maximum Month Demand
MOA	Memorandum of Agreement
MPN	Most Probably Number
msl	Mean sea level
MWD	Metropolitan Water District of Southern California
MWRF	Meadowlark Water Reclamation Facility
NDMA	N-nitrosodimethylamine
NTU	Nephelometric Turbidity Unit
OOS	Out of Service
O&M	Operations and Maintenance
OMWD	Olivenhain Municipal Water District
PCBs	Polychlorinated Biphenyls
PHD	Peak Hour Demand
PRS	Pressure Regulating Station

Abbreviation	Description
PRV	Pressure Reducing Valve
PSV	Pressure Sustaining Valve
PS	Pump Station
psi	Pounds per square inch
PVC	Polyvinyl chloride
RO	Reverse Osmosis
RWMP	Recycled Water Master Plan
RWQCB	Regional Water Quality Control Board
SAR	Sodium Adsorption Ratio
SCADA	Supervisory Control and Data Acquisition
SDCWA	San Diego County Water Authority
SDWA	Safe Drinking Water Act
SF	Single Family
SLRWRF	San Luis Rey Wastewater Reclamation Facility
SMCL	Secondary Maximum Contaminant Level
STL	Steel
SWRCB	State Water Resources Control Board
SWTF	Stormwater Treatment Facility
TAP	Tri-Agency Pipeline
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
VID	Vista Irrigation District
VWD	Vallecitos Water District
VFD	Variable Frequency Drive
WDF	Water Demand Factor
WPCF	Water Pollution Control Facility
WRF	Water Reclamation Facility
WRP	Water Reclamation Plant

This page intentionally left blank.

EXECUTIVE SUMMARY

ES.1 PROJECT BACKGROUND

Carlsbad Municipal Water District (CMWD) started its recycled water program in 1990 with the preparation of its first Recycled Water Master Plan (RWMP). Subsequently, CMWD issued a mandatory use ordinance and started implementing the recycled water system facilities of Phase I. CMWD served over 1,000 acre-feet per year (afy) of recycled water by 1995. The implementation of Phase II started in 2000 and included construction of the 4-mgd Carlsbad Water Recycling Facility (CWRF) and expansion of the Meadowlark Water Reclamation Facility (MWRF), improvements to Mahr Reservoir, three new booster pump stations, and 24 miles of additional recycled water pipeline. Construction of Phase II was completed in 2008 and the CMWD currently serves approximately 4,000 afy of recycled water.

With Phase II near completion, CMWD initiated the development of this RWMP update to evaluate the capabilities of the existing recycled water system, define the most cost-effective system expansions through build out conditions, and develop a capital improvement program (CIP). This CIP includes a recommended phasing strategy and defines the Phase III projects. A separate Phase III Project Feasibility Study was also prepared as part of this project but is documented in a separate report.

ES.2 STUDY AREA

The study area of this RWMP is the existing service area of CMWD as well as areas within neighboring districts adjacent to CMWD's service area. As shown in Figure ES.1, CMWD currently provides potable water and recycled water within a portion of the City of Carlsbad (City) located approximately 35 miles north of downtown San Diego. CMWD's existing recycled water system extends to all parts of the City except the northwest quadrant. This RWMP evaluates opportunities to expand recycled water service throughout CMWD's service area as well as to a select number of large potential recycled water customers in neighboring communities.

ES.3 EXISTING RECYCLED WATER SYSTEM

CMWD's primary recycled water distribution system consists of five pressure zones, three storage tanks, three booster pumping stations, two supply sources with pump stations, and three pressure regulating stations. CMWD also supplies recycled water to the south course of the La Costa Resort and Spa from the Gafner Water Reclamation Plant (WRP) through a separate distribution system with dedicated service to the south golf course of the La Costa Resort and Spa. The location of these facilities and supply sources are shown in Figure 2.1 of this RWMP.

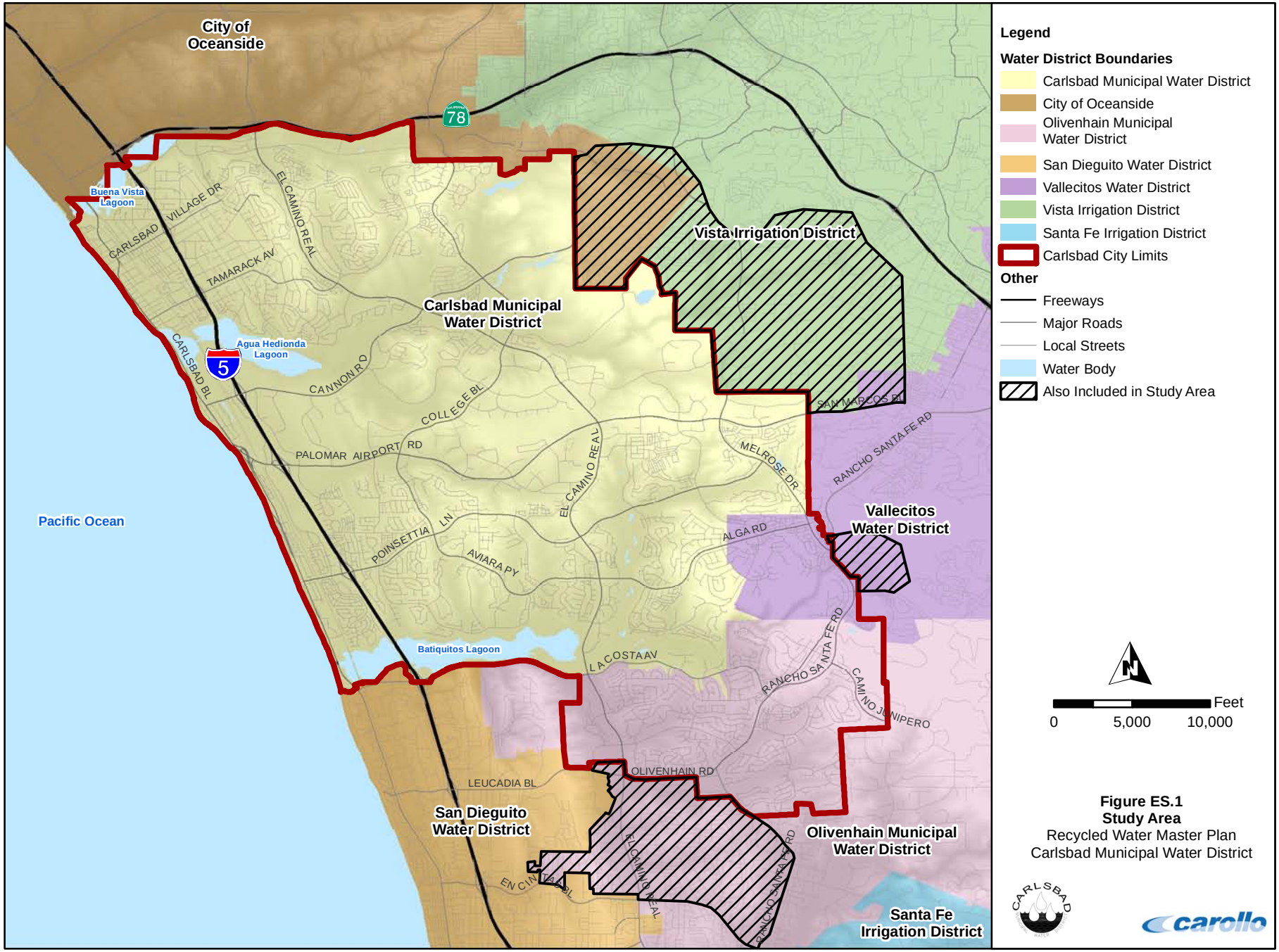


Figure ES.1
Study Area
Recycled Water Master Plan
Carlsbad Municipal Water District

ES.4 RECYCLED WATER SUPPLIES

CMWD currently receives recycled water from the Carlsbad Water Recycling Facility (WRF), owned by CMWD but operated by the Encina Wastewater Authority (EWA), the Meadowlark WRF, owned and operated by the Vallecitos Water District (VWD), and the Gafner WRP, owned and operated by the Leucadia Wastewater District (LWWD). Table ES.1 summarizes the existing supply sources of recycled water for CMWD, while the locations of each of these facilities are shown on Figure ES.3.

Table ES.1 Recycled Water Supplies
Recycled Water Master Plan
Carlsbad Municipal Water District

Reclamation Plant Name	Owner	Permitted Capacity[(1)] (mgd)	Maximum CMWD Allocation (mgd)	Other Allocations (mgd)
CWRF	CMWD	4.0	4.00	0.0
MWRF	VWD	5.0	3.00[(1)]	1.5[(1)]
GWRP	LWWD	1.0	0.75[(1)]	0.0
Total Capacity		**10.0**	**7.75**	**1.5**
Total Usable Capacity[(1)]			**7.60[(1)]**	

Notes:
VWD = Vallecitos Water District; LWWD = Leucadia Wastewater District; GWRP = Gafner WRP
(1) Details and assumptions are included in Chapter 4.

To serve the projected recycled water demands, six (6) different supply alternatives were developed. Each alternative has an assumed total build out supply capacity of 14-mgd, which was used to develop comparable alternatives. The six alternatives are:

- Alternative 1 - Maximize use of Carlsbad WRF
- Alternative 2 - Maximize use of Meadowlark WRF
- Alternative 3 - Maximize use of Gafner WRP
- Alternative 4 - Abandon Gafner WRP
- Alternative 5 - Maximize use of Carlsbad WRF and Lake Calavera
- Alternative 6 - Utilize Shadowridge WRP

The breakdown of the distribution of supplies to add up to 14 mgd for each of the six alternatives is summarized in Table ES.2.

Table ES.2 Supply Alternatives Summary
Recycled Water Master Plan
Carlsbad Municipal Water District

Supply Source Facility	Treatment Flow[(1)] (mgd)					
	Alternative 1 Maximize CWRF	Alternative 2 Maximize MWRF	Alternative 3 Maximize GWRP	Alternative 4 Abandon GWRP	Alternative 5 Maximize CWRF and Lake Calavera	Alternative 6 Utilize Shadowridge WRP
Carlsbad WRF	10.25	9.75	7.00	11.00	9.00	9.75
Meadowlark WRF	3.00	3.50	3.00	3.00	3.00	3.00
Gafner WRP	0.75	0.75	4.00	-	0.75	0.75
Calavera Reservoir SWTF	-	-	-	-	1.00	-
Seasonal Storage	-	-	-	-	0.25	0.20
Shadowridge WRP	-	-	-	-	-	0.30
Total	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**

Notes:
WRF = Water Reclamation Facility; WRP = Water Reclamation Plant; SWTF = Stormwater Treatment Facility
(1) Details and assumptions are included in Chapter 4.

A summary of the estimated capital cost and unit supply cost in $/acre-foot (af) are listed in Table 4.11 and graphically presented on Figure ES.2.

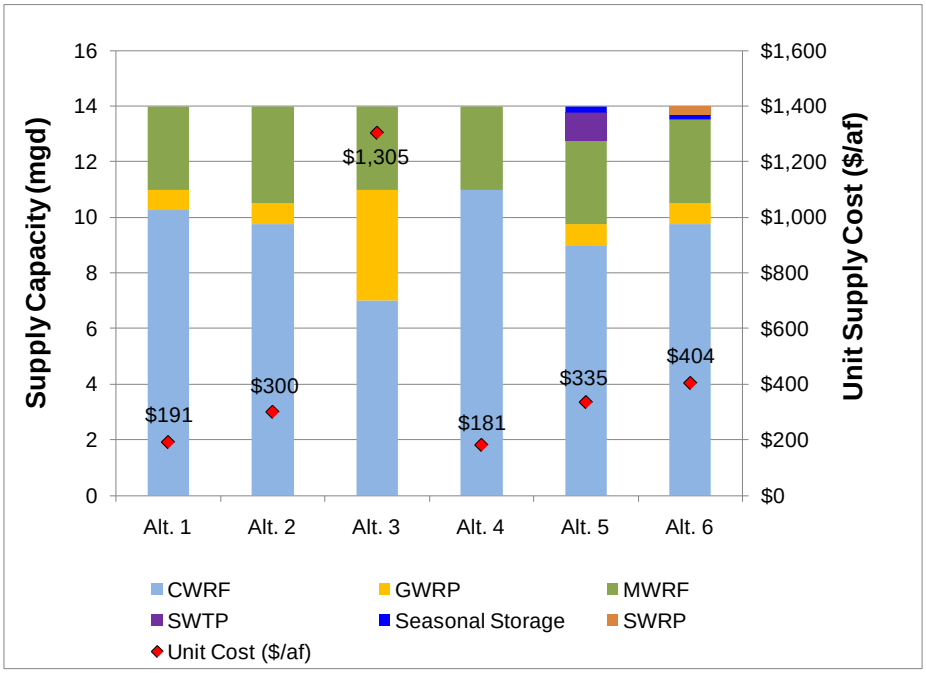


Figure ES.2 Supply Alternatives Comparison

As shown on Figure ES.2, the majority of the recycled water supply capacity is produced at the Carlsbad WRF in all alternatives, ranging from 7 to 11 mgd of the total 14-mgd supply capacity. This figure clearly shows that the variations between alternatives are determined by the supply mix of the remaining 3 to 7 mgd of the total 14 mgd capacity.

The narrow variation in supply mix between the five of the six alternatives is caused by the limited supply availability and/or expansion opportunities for the GWRP, MWRF, SWTP, and SWRP. The Carlsbad WRF is the only treatment plant with extensive expansion opportunities and already has a secondary treatment capacity of 43.3 mgd.

In addition to the supply mix of each alternative, Figure ES.2 also shows that the estimated unit capital supply cost in dollars per acre-foot range from $181/af to $1,305/af. Alternative 4 is the most cost-effective scenario, while Alternative 1 the second best alternative.

More details on each supply source and the supply evaluation is provided in Chapter 4 of this RWMP.

ES.5 RECYCLED WATER DEMANDS

ES.5.1 Existing Demands

CMWD's recycled water demand has steadily increased from zero afy at the start of Phase I in 1990 to 4,350 afy in calendar year 2009. As of December 2010, CMWD serves 362 customers. CMWD's top five largest customers comprise over one-third of the total demand for 2009. In addition, Home Owners Association (HOA) irrigation and commercial property irrigation, such as shopping centers and business parks, comprise a significant portion of the system's total demand. For planning purposes, the existing distribution system is estimated to serve approximately 4,000 afy.

ES.5.2 Near-Term Demands

CMWD is already in the process of connecting nearly 50 new (near-term) customers with a combined demand of 100 afy. This demand is therefore referred to as the so-called "near-term" demand.

ES.5.3 Future Demand Projections

The future recycled water demands were projected using a variety of sources, including potable water billing records, land use maps, aerial photography, previous reports, studies from neighboring agencies, and discussions with CMWD staff. A list of 161 potential new recycled water customers was developed and input into a GIS database. The total additional potential future demand based on the customer database is nearly 5,368 afy. This demand includes all potential users including future developments, but does not include several potential agricultural users since they are temporarily occupying land

planned for future home owners associations and commercial developments. The customers were separated into four main categories and thirteen subcategories, which are described in more detail in Chapter 3. A detailed list of all potential customers is included in Appendix B.

In addition to the customer database, demand estimates were prepared for agricultural areas that can be temporarily served with recycled water and vacant areas for which no specific plans are available at this time.

The total demand for the ultimate system is projected by combining the demands from existing and near-term customers, the potential customer database, and the arnew developments. Table ES.3 presents a summary of demand projections. This table also lists the corresponding table in Chapter 3 that provides more detail on each demand estimate.

Table ES.3 Summary of Demand Projections
Recycled Water Master Plan
Carlsbad Municipal Water District

Customer Category	Demand (afy)	Source
Existing	4,000	Section 3.3.2
Near Term / In Progress	100	Section 3.5.3
Customer Database	5,368	Table 3.7
New Developments	344	Table 3.9
Potential Total Demand	**9,812**	
Not Feasible	-706	Table 3.13
Total for Build-out System	**9,106**	

As shown, the total potential recycled water demand is estimated at 9,812 afy. It should be noted that this is not the build out demand included in the CIP, as the location of certain potential customers would require cost-prohibitive infrastructure expansions.

The feasibility analysis of the various pipeline alignments required to serve this total potential demand is described in Chapter 9, Future System Analysis. The results of this analysis were used to prioritize pipeline extension projects and determine the build out demand that is considered for the CIP projects presented in Chapter 10 of this RWMP. As shown in Table ES.3, a total of 706 afy in potential demand is considered not feasible, resulting in a build out demand of 9,106 afy. This equates to an average day demand (ADD) of 8.1 mgd and a maximum day demand (MDD) of 13.5 mgd.

The list of potential customers includes customers outside CMWD's service area. As presented in Chapter 3, nearly 50 percent of the potential customers identified within this plan are located inside CMWD's service area. Implementation of the system expansions described in this RWMP would therefore require collaboration with neighboring agencies

and not only offset potable water demands within CMWD's service area, but also diversify supplies in neighboring agencies.

Currently, recycled water use accounts for almost 20 percent of the aggregate water within CMWD. If all potential demands within CMWD are connected by year 2020, CMWD could reach 27 percent recycled water when compared to total demand.

ES.6 HYDRAULIC MODEL

A hydraulic model was developed and calibrated for this project to evaluate the existing system and determine the future system expansions projects for the CIP. A detailed description of the model creation and calibration is included in Chapter 6 of this RWMP.

ES.7 EXISTING SYSTEM EVALUATION

The hydraulic model was used to evaluate the system hydraulics of the existing recycled water distribution system. The evaluation and planning criteria used for this evaluation are described in Chapter 7 of this RWMP. In summary, the following conclusions were made:

- All booster pump stations are adequately sized.
- The system has sufficient reservoir storage.
- The system has sufficient recycled water supplies to meet MMD.
- There are some hydraulic deficiencies in the distribution system such as areas with high velocity, high head loss, high pressure, or low pressure.
- There are a few locations with low chlorine residual levels.

After an evaluation of the severity of the deficiencies, replacement of the existing system was not recommended. To resolve the water quality deficiencies, the following recommendation was made and included in the CIP, which is presented in Chapter 10 of this RWMP:

- Installation of a chlorination and mixing system in "C" Tank to maintain an adequate residual during periods of low demand.

ES.8 FUTURE SYSTEM EVALUATION

The hydraulic model was expanded by connecting potential customers identified in the future customer database. Pipeline alignments were selected with input from CMWD staff in an attempt to connect all potential customers. The model with this build out distribution system was then used to size pipelines, define pressure zone boundaries, locate new booster pumping stations and reservoirs.

The pipeline alignments of this build out system were then divided into 18 different expansion segments. The alignments of the segments are shown on Figure ES.3, while a summary of the potential customer demands by segment is provided in Table 9.1.

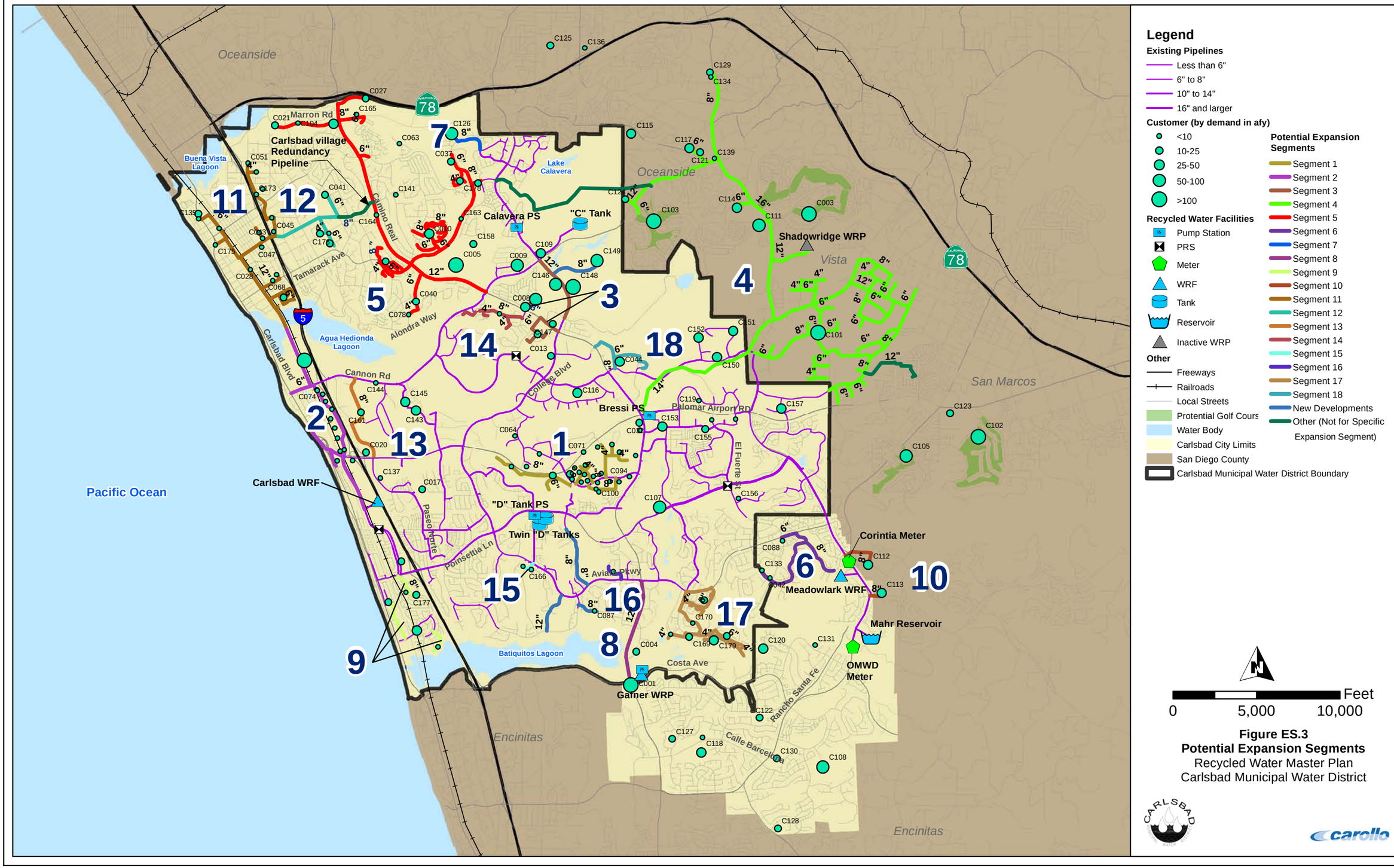
To determine the most cost-effective system expansion, the various segments were evaluated based on the estimated conveyance cost in dollars per acre-foot of demand served ($/af). The segments were then prioritized based on unit conveyance cost and incorporated in the CIP. The resulting ranking is presented in Figure ES.4.

Table ES.4 Summary of Ultimate Demands by Phase
Recycled Water Master Plan
Carlsbad Municipal Water District

Phase	Ultimate System Demand (afy)	Average Day Demand (mgd)	Maximum Month Demand[(2)] (mgd)
Existing + Near Term	**4,100**	**3.7**	**6.3**
Phase III Expansion Segments[(1)]	3,314	2.9	4.7
Phase III Subtotal	***3,314***	***2.9***	***4.7***
Phase III Total	**7,414**	**6.6**	**11.0**
Build Out Expansion Segments	1,348	1.2	2.0
Development of Vacant Land	344	0.3	0.5
Build-Out Phase Subtotal	***1,692***	***1.5***	***2.5***
Ultimate System Total	**9,106**	**8.1**	**13.5**

Notes:
(1) Assumes that all potential customers adjacent to the existing system are connected during Phase III
(2) MMD peaking factors vary by customer (see Appendix C for details).

As shown in Table ES.4, a total of 9,106 afy of demand was identified as the ultimate system demand. It is estimated that the total Phase III demand would be approximately 7,414 afy.



Legend

Existing Pipelines
- Less than 6"
- 6" to 8"
- 10" to 14"
- 16" and larger

Customer (by demand in afy)
- <10
- 10-25
- 25-50
- 50-100
- >100

Recycled Water Facilities
- Pump Station
- PRS
- Meter
- WRF
- Tank
- Reservoir
- Inactive WRP

Other
- Freeways
- Railroads
- Local Streets
- Potential Golf Cours
- Water Body
- Carlsbad City Limits
- San Diego County
- Carlsbad Municipal Water District Boundary

Potential Expansion Segments
- Segment 1
- Segment 2
- Segment 3
- Segment 4
- Segment 5
- Segment 6
- Segment 7
- Segment 8
- Segment 9
- Segment 10
- Segment 11
- Segment 12
- Segment 13
- Segment 14
- Segment 15
- Segment 16
- Segment 17
- Segment 18
- New Developments
- Other (Not for Specific Expansion Segment)

N

0 5,000 10,000 Feet

Figure ES.3
Potential Expansion Segments
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 1/18/2011 FILENAME: c:\pw_working\projectwise\lwang\d0102644\Figure_ES_3-Expansions Segment by Color.mxd

This page intentionally left blank.

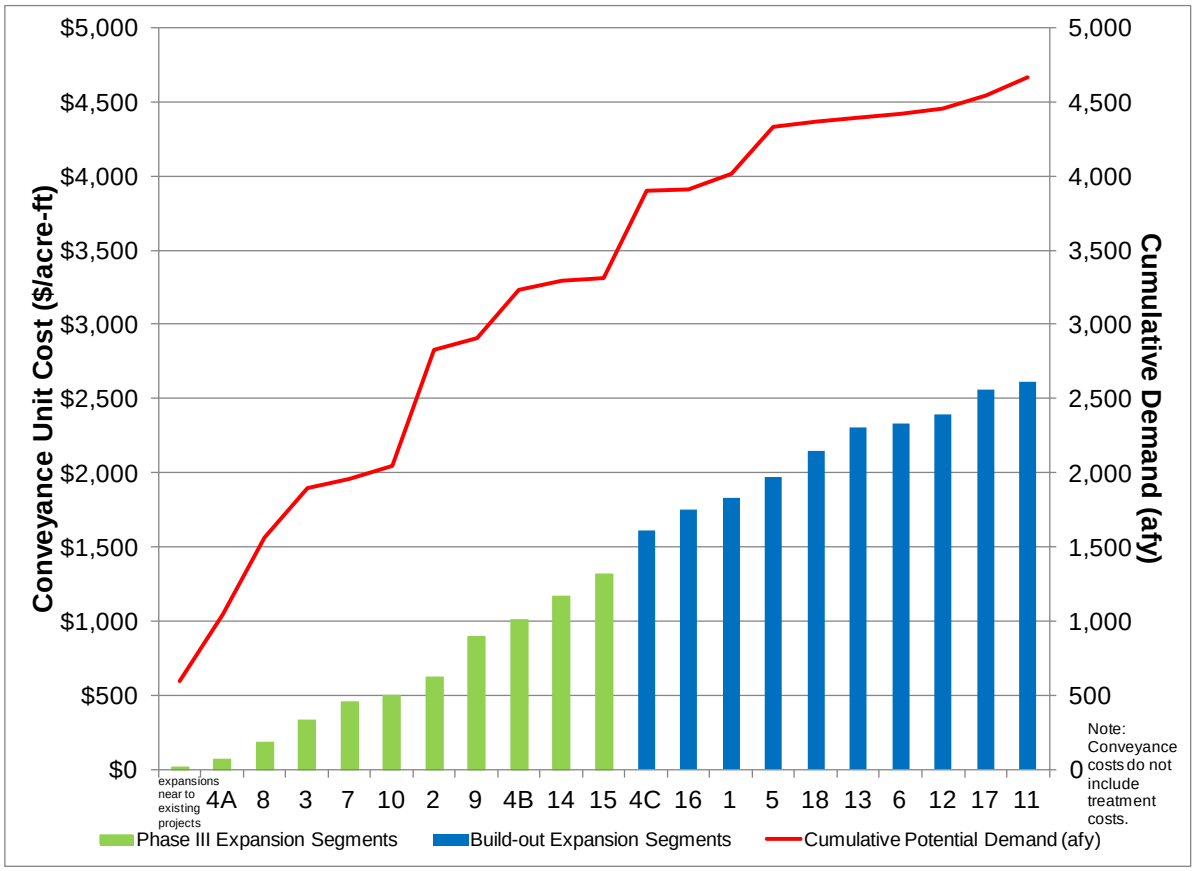


Figure ES.4 Expansion Segment Unit Costs

As shown in Figure ES.4, the estimated conveyance unit costs for the segments range significantly, from less than $100/acre-foot to over $2,500/acre-foot. This figure also shows the cumulative demand of all expansion segments as 4,662 afy. It should be noted that this does not include the existing system demand, near-term demand, or the demand of customers located adjacent to the existing system that do not require new pipeline segments. A summary of the total ultimate demand by phase is shown in Table ES.4.

This figure also shows that the incremental new demand decreases significantly after implementation of expansion segment 15, while the unit cost for conveyance continues to increase. As this is close to the point where the unit conveyance costs exceed $1,500/acre-foot, it was decided to define all segments up to Expansion Segment 4C as Phase III and categorize the remaining segments for the build out, as discussed in Chapter 9.

ES.9 CAPITAL IMPROVEMENT PROGRAM

The CIP is divided into three phases. The existing phase includes recommendations made as a part of the existing system analysis. The second phase consists of the projects to be implemented as a part of the Phase III improvement program, while the third phase consists of the remaining projects anticipated through build-out of the recycled water system. The locations of the projects included in Phase III and the Build-out Phase are shown on Figure ES.5.

The breakdown of cost by phase is summarized in Table ES.5.

Table ES.5 Capital Cost by Planning Phase
Recycled Water Master Plan
Carlsbad Municipal Water District

Project Type	Existing	Phase III	Build-out Phase	Total
Pipelines	$0.0	$20.7	$40.1	$60.7
Treatment	$0.0	$7.0	$5.5	$12.5
Storage	$0.1	$4.6	$5.7	$10.4
Total	**$0.1**	**$32.3**	**$51.3**	**$83.7**

Note:
(1) Capital Costs are based on the cost assumptions discussed in Chapter 10. Detailed information for each project can be found in Table 10.4.

As shown in Table ES.5, the total capital cost for existing system improvements is about $0.6 million, while the capital cost of Phase III is estimated at $32.3 million. The expansions required to connect all customers of the Build-out Phase will add approximately $51.3 million in capital cost, for a total capital cost of $83.7 million.

This table also shows that pipelines represent the largest component of the total capital cost at about $60.7 million. Treatment and storage are similar in cost, at $12.5 million and $10.4 million, respectively. Figure ES.6 presents the capital cost by project type graphically.

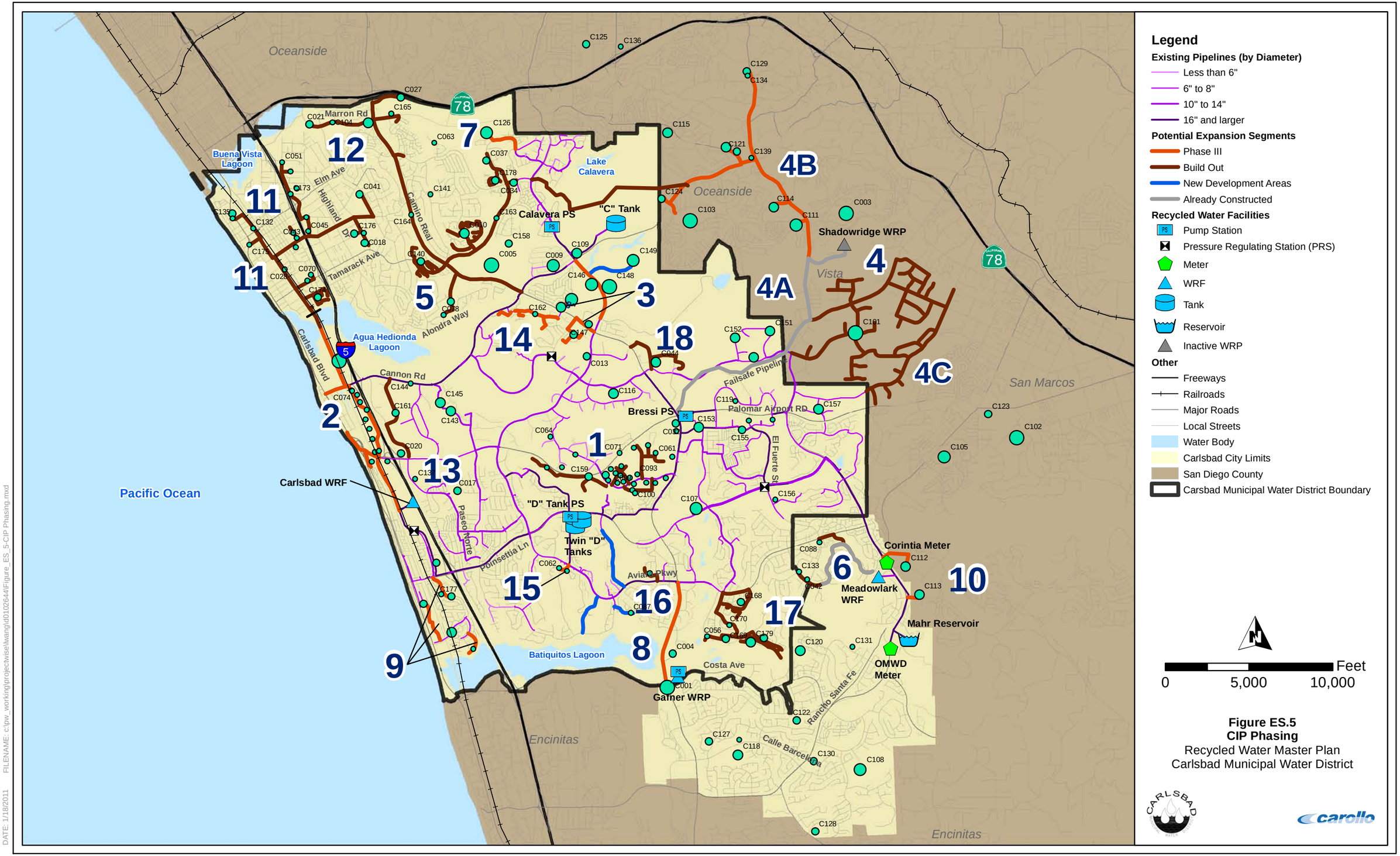


Figure ES.5
CIP Phasing
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 1/18/2011 FILENAME: c:\pw_working\projectwiselwangld\d0102644\Figure_ES_5-CIP Phasing.mxd

This page intentionally left blank.

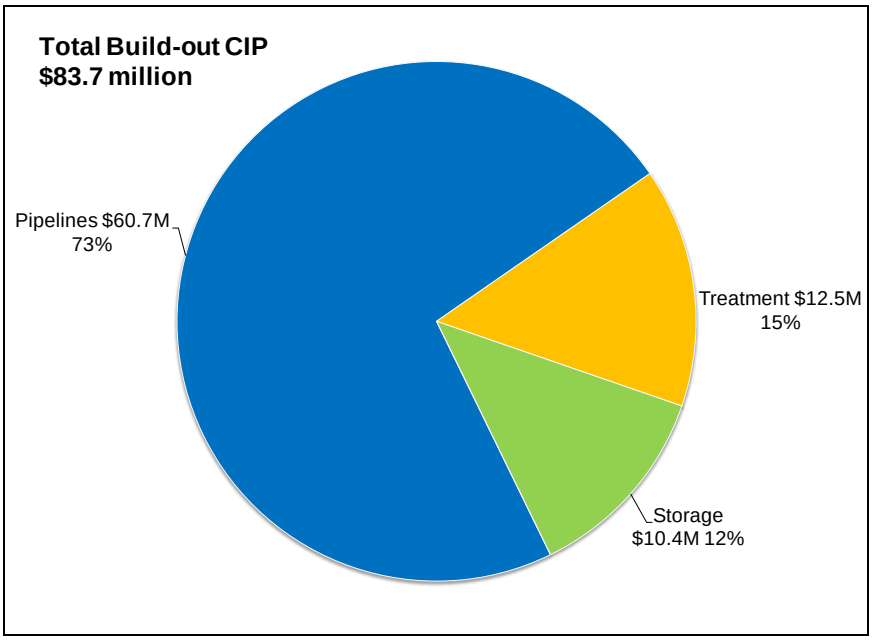


Figure ES.6 Capital Cost by Project Type

It is anticipated that completion of Phase III will require approximately 10 years (2011-2020), five years for building the Phase III infrastructure and five years to connect the customers. It is assumed that the Build-out Phase is will take another ten years and be completed by 2030. Based on this timing, the escalated capital project costs were estimated as shown in Table ES.6.

Table ES.6 Escalated CIP by Planning Phase
Recycled Water Master Plan
Carlsbad Municipal Water District

Phase	Period	Capital Cost ($million)	Escalated Capital Cost ($million)
Existing	2010	$0.1	$0.2
Phase III	2011-2020	$32.3	$35.3
Build-out Phase	2021-2030	$51.3	$75.4
Total	**n/a**	**$83.7**	**$110.9**

Figure ES.7 depicts the estimated escalated unit recycled water cost compared to the anticipated potable water unit cost from the San Diego County Water Authority, which provides the alternate water supply to CMWD.

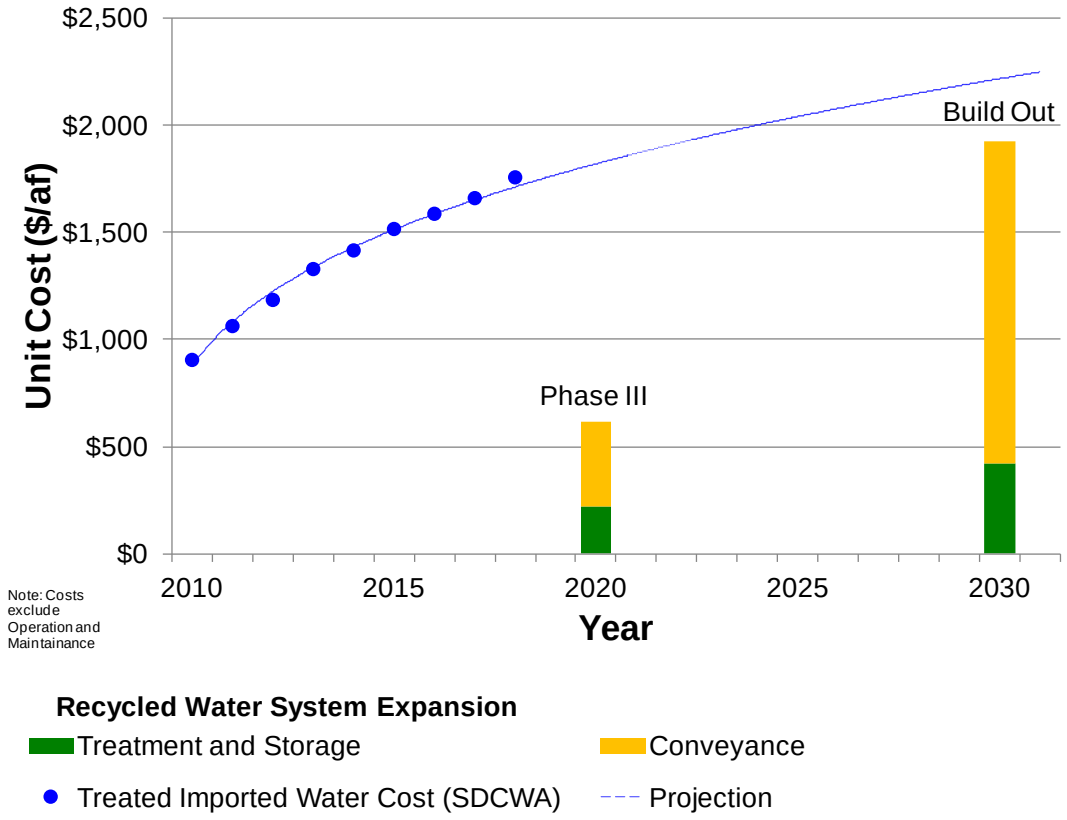


Figure ES.7 Comparison of Unit Costs to Imported Water

As shown in Figure ES.7, the anticipated unit cost of recycled water for each phase is below the projected imported water costs for the same time period. Based on this comparison it is concluded that the expansion of CMWD's recycled water system in both Phase III and through Build Out conditions is a cost-effective alternative for potable water supply. In addition to the cost benefit, recycled water provides increased supply reliability, especially during drought periods, and allows CMWD remains more in control of the overall water supply cost for its customers.

1.1 INTRODUCTION

Many Southern California communities must contend with a multitude of challenges when providing a reliable water supply. The drought occurring through 2010, legal and environmental constraints, climate change, and population growth all have the aggregate effect of reducing the reliability of most water supplies. As recycled water provides a reliable, drought-resistant supply, the Carlsbad Municipal Water District (CMWD) has been providing recycled water to the City of Carlsbad (City) since 1991. To continue this program, CMWD has undertaken this Recycled Water Master Plan (RWMP) update to guide the continued development of its recycled water system.

This chapter includes descriptions of the project background, study area, and project objectives. In addition, acknowledgments and an overview of the report organization are included. A list of reference documents used for the preparation of this RWMP is included in Appendix A, while a list of abbreviations and acronyms is included after the Table of Contents.

1.2 PROJECT BACKGROUND

The CMWD started its recycled water program in 1990 with the preparation of its first Recycled Water Master Plan. Subsequently, CMWD issued a mandatory use ordinance and started implementing the recycled water system facilities of Phase I. With recycled water purchased from neighboring agencies, Vallecitos Water District (VWD) and Leucadia Wastewater District (LWWD), CMWD served over 1,000 acre-feet per year (afy), or 0.89 million gallons per day (mgd), of recycled water by 1995. With Phase I complete, CMWD hired Carollo Engineers in 1997 to update its recycled water master plan and prepare a plan for the Phase II expansion. Phase II included construction of the 4 mgd (4,480 afy) Carlsbad Water Recycling Facility (CWRF), increased supply from the Meadowlark Water Reclamation Facility (MWRF) from 2.25 mgd (2,520 afy) to 5 mgd (5,600 afy), reliability and control improvements to Mahr Reservoir, three new booster pump stations, and 24 miles of additional recycled water pipeline.

Construction of Phase II was initiated in 2004, and went into full operation in January 2008. Currently, CMWD is still connecting Phase II customers to the distribution system and the Phase II system demand is anticipated to increase to approximately 5,000 afy (4.5 mgd) once all Phase II customers are connected. With Phase II near completion, CMWD is ready to take the next steps for further recycled water system expansion. With most of the large water customers already converted to recycled water, the next challenge is finding cost effective expansions that effectively continue the development of CMWD's recycled water system. The purpose of this Recycled Water Master Plan (RWMP) Update is to document

the capabilities of the existing system and evaluate potential system expansions. The goal of this document is to determine preferred system expansions and develop a capital improvement program (CIP) with a phased implementation approach to reach build out conditions. In addition, a separate Phase III Project Feasibility Study was prepared as part of this project that provides details on the implementation of Phase III.

1.3 STUDY AREA

The project study area is the service area of CMWD as well as some of the surrounding areas of neighboring agencies. CMWD provides potable water and recycled water within a portion of the City of Carlsbad (City) located approximately 35 miles north of downtown San Diego. As shown in Figure 1.1, CMWD's service area covers most of the City's boundary, with special service districts providing service for the southeast corner of the City. It should be noted that, through an agreement dated September 24, 2008 (included in Appendix D), CMWD retails recycled water within VWD outside CMWD's service area but within the City of Carlsbad.

CMWD is a subsidiary district of the City of Carlsbad. The mayor and City Council are CMWD's governing board. CMWD management and engineering operates under the City's Utilities Department. CMWD is governed by the Municipal Water District Act of 1911.

The City is a member of the Encina Wastewater Authority (EWA) along with the City of Vista, the City of Encinitas, the Buena Sanitation District, LWWD, and VWD. Wastewater treatment is handled on a regional basis by EWA. The study area includes both wastewater supply sources outside of the CMWD boundary and potential customers outside the CMWD boundary who could purchase recycled water. CMWD's boundary in relation to these wastewater agencies is shown in Figure 1.2.

Currently, CMWD's existing recycled water system extends to all parts of CMWD except the upper portion of the northwest quadrant. This RWMP evaluates opportunities to expand recycled water service throughout CMWD's service area as well as to a select number of large potential recycled water customers in neighboring communities.

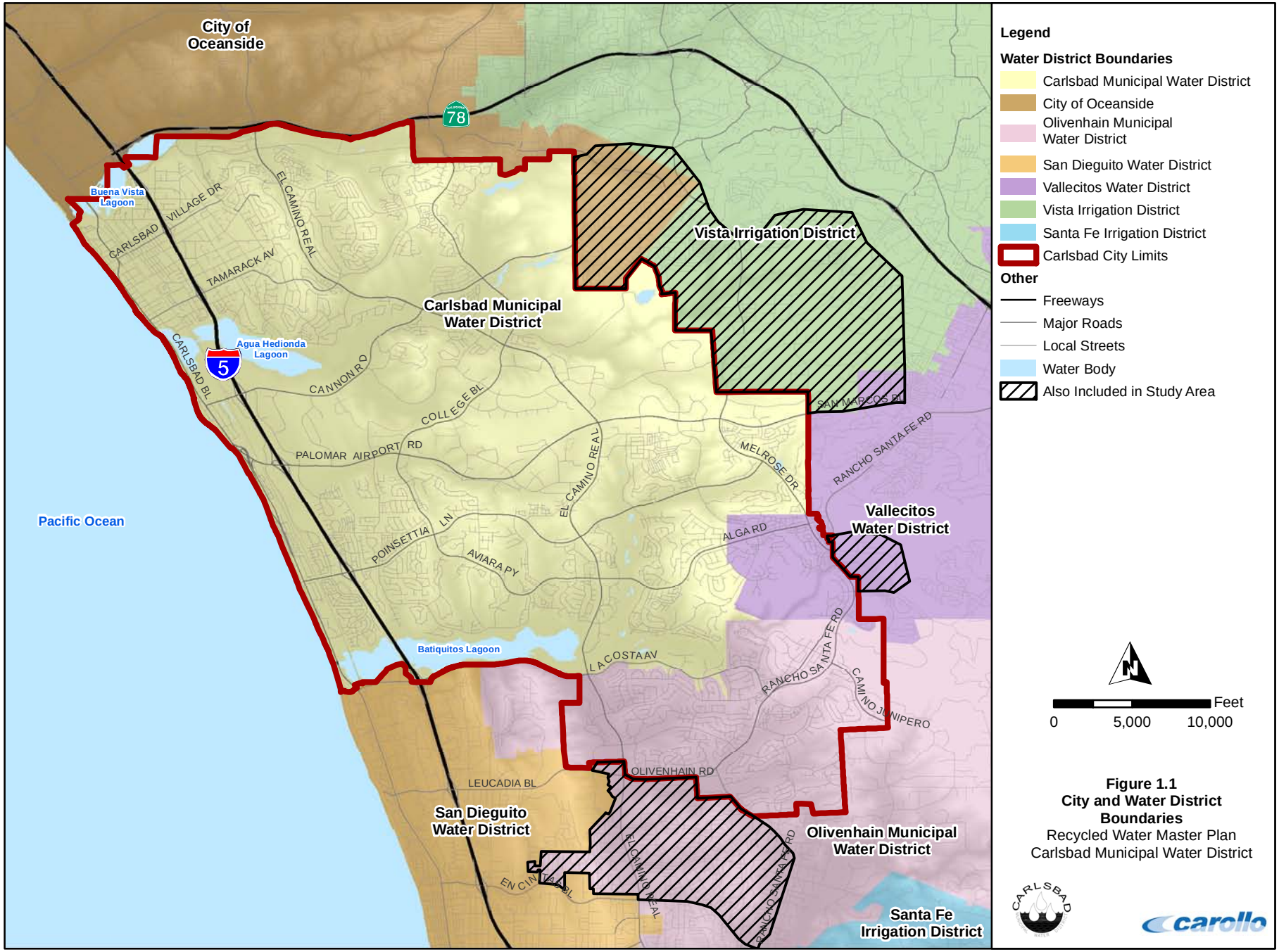


Figure 1.1
City and Water District Boundaries
Recycled Water Master Plan
Carlsbad Municipal Water District

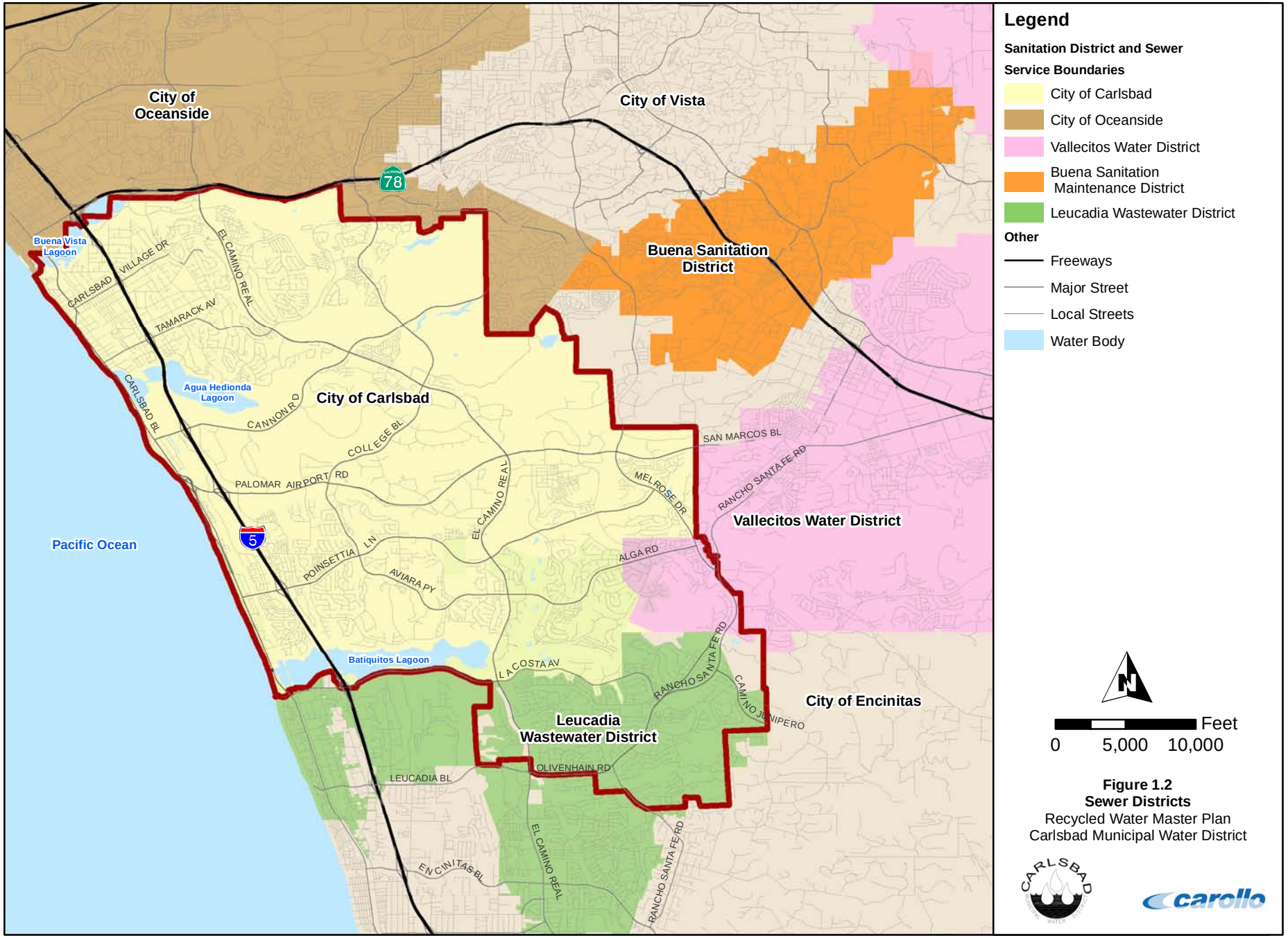


Figure 1.2
Sewer Districts
Recycled Water Master Plan
Carlsbad Municipal Water District

1.4 PROJECT OBJECTIVES

The intent of this project is to provide a RWMP that will guide CMWD as it develops and expands the current recycled water distribution system to build out. CMWD wants to maximize the use of recycled water as this is now the lowest cost water supply source. Specific project objectives are as follows:

- Maximizing recycled water use in and around CMWD.
- Finding cost effective system expansion opportunities.
- Optimizing the existing and future system configuration.

The plan culminates in a CIP that is intended to serve as guidance for CMWD to meet the desired objectives. The CIP identifies several recycled water projects for CMWD, outlines the recommended phasing of these projects, and includes planning level opinions of probable construction cost.

1.5 ACKNOWLEDGEMENTS

Carollo wishes to acknowledge and thank all of the City's staff for their support and assistance in completing this master plan. Special thanks go to Bill Plummer, David Ahles, and Elzbieta Karczewski.

Deputy City Engineer:	Bill Plummer, P.E.
Senior Engineer:	David Ahles, P.E.
Engineering Technician:	Elzbieta Karczewski
Public Works Superintendent:	Steve Plyler
Public Works Supervisor:	Jase Warner
Senior Cross Connection Technician:	Pam James-Adams

The following Carollo staff were principally involved in the preparation of this RWMP:

Partner-in-Charge:	Gil Crozes, Ph.D., P.E.
Project Manager:	Inge Wiersema, P.E.
Project Engineer:	Brian Brenhaug, P.E.
Technical Review:	Dan Baker, P.E.
Project Support Staff:	Tracy Clinton, P.E. Mark Bartlett, P.E. Dawn Guendert Li-Chen Wang

Carollo teamed with CH2M HILL for this RWMP update. Key staff members from CH2M HILL involved in this project were:

Project Manager:	Scott Lynch, P.E. Anne Lynch, P.E.
Project Engineer:	Jessica Prince, P.E. Xiaoyi Zhang

1.6 REPORT ORGANIZATION

This recycled water master plan is divided into 10 chapters. A brief description of the content of each chapter is provided below.

- **Chapter 1 – Introduction:** This chapter includes descriptions of the project background, study area, and project objectives. In addition, acknowledgments and an overview of the report organization are included.
- **Chapter 2 – Existing Recycled Water System:** This chapter provides a brief overview of CMWD's existing recycled water system including descriptions of the existing recycled water distribution system/facilities, recycled water supply sources, recycled water demands as well as known system deficiencies.
- **Chapter 3 – Recycled Water Demands:** This chapter presents a discussion of CMWD's estimated recycled water demands, including analysis of historical recycled water demands, recycled water demand factors and peaking factors. This chapter also summarizes the findings of the recycled water market assessment, a list of identified potential customers, and the projected recycled water demands for Phase III and build out conditions.
- **Chapter 4 – Recycled Water Supplies:** This chapter identifies the supply and related storage needs required to meet the projected water demands identified in Chapter 3, including descriptions of the existing and future recycled water supply sources, a discussion of water quality of existing supply sources, a comparison of the capacity of the identified sources with the projected recycled water demands to determine any supply shortfalls, a supply evaluation consisting of four supply scenarios, and a discussion of recommended supply strategy.
- **Chapter 5 – Recycled Water Regulations.** This chapter identifies the regulations that govern the implementation and use of recycled water by CMWD, including current and anticipated recycled water regulations as well as recommendations for changes to CMWD's design standards.

- **Chapter 6 – Hydraulic Model:** This chapter discusses development and calibration of the hydraulic model of CMWD's existing recycled water system including descriptions of CMWD's previous hydraulic model, the various data sources used to create the model, the modeling of facilities and their controls, the allocation of demands, and the details of the calibration process. This chapter also documents development of the future system model.

- **Chapter 7 – Planning and Evaluation Criteria:** This chapter summarizes the analysis criteria used in the existing and future system analysis, as well as planning criteria used in development of the capital improvement program.

- **Chapter 8 – Existing System Evaluation:** This chapter covers the analysis performed on the existing system and summarizes results of that analysis, including existing system deficiencies and recommendations for improvements to optimize the existing system. This chapter also includes a discussion of inspection and maintenance requirements and costs.

- **Chapter 9 – Future System Evaluation:** This chapter documents analysis of the future system and summarizes results of that analysis. This chapter will include an evaluation of the different routing alternatives and laterals to serve the potential customers identified in Chapter 3 from the various supply alternatives discussed in Chapter 4.

- **Chapter 10 – Capital Improvement Program:** This chapter provides planning level cost estimates for the improvements recommended in Chapters 8 and 9. This CIP includes a phased implementation schedule with a planning horizon of 2030 and a separate project list for Phase III. A detailed implementation plan for Phase III is presented in a separate report, the Phase III Feasibility Study.

This page intentionally left blank.

Chapter 2

EXISTING RECYCLED WATER SYSTEM

2.1 INTRODUCTION

This chapter provides a brief overview of Carlsbad Municipal Water District's (CMWD) existing recycled water system including descriptions of the existing recycled water distribution system/facilities, recycled water supply sources, and recycled water demands.

A more detailed description of the recycled water distribution system pipelines and facilities is included in Chapter 6 (Hydraulic Model Development), while detailed descriptions of the existing and future recycled water demands and supplies are included in Chapter 3 (Recycled Water Demands) and Chapter 4 (Recycled Water Supplies), respectively.

2.2 SERVICE AREA

CMWD's existing recycled water system is shown on Figure 2.1. As shown, CMWD currently provides recycled water to customers inside and outside CMWD's service area, but are nearly within the City of Carlsbad (City).

Most of CMWD's recycled water distribution system is within CMWD's service area. However, two portions of the recycled water distribution system are located outside CMWD's service area. A 12-inch transmission main in Pressure Zone 660 is located within the Vista Irrigation District (VID) to the East of CMWD's service area along Melrose and Faraday Avenue.

A 30-inch transmission main outside CMWD's service area is also located where CMWD's recycled water distribution system is fed from Meadowlark Water Reclamation Facility (MWRF) within the service area of Vallecitos Water District (VWD). This pipeline ends along Rancho Santa Fe Road, located to the southeast of CMWD's service area. CMWD also serves recycled water customers in the VWD within the City per the Mahr Reservoir Use Agreement found in Appendix D.

2.3 EXISTING RECYCLED WATER SUPPLIES

CMWD receives recycled water from reclamation plants within the Encina Wastewater Authority (EWA) service area. EWA is a public agency owned by the City of Carlsbad, City of Vista, City of Encinitas, VWD, Buena Sanitation District (BSD), and Leucadia Wastewater District (LWWD). EWA is operated through a Joint Powers Agreement date April 21, 2005 (see Appendix D). Under the Joint Powers Agreement, these six agencies share the costs and management of wastewater treatment services through a joint outfall system. EWA manages the 36-mgd Encina Water Pollution Control Facility (EWPCF) and the Encina Ocean Outfall (EOO) at the terminus of this joint system. Member agencies are responsible

for their individual wastewater collection systems that feed the trunk mains terminating at the EWPCF.

CMWD receives recycled water from Meadowlark WRF, owned and operated by the Vallecitos Water District, the Carlsbad Water Recycling Facility (CWRF), owned by CMWD but operated by the EWA, and the Gafner Water Reclamation Plant (GWRP), owned and operated by the LWWD. The ownership and capacity allocations from these three sources are summarized in Table 2.1.

Table 2.1 Recycled Water Supplies
Recycled Water Master Plan
Carlsbad Municipal Water District

Reclamation Plant Name	Owner[1]	CMWD Allocation		Total Supply Capacity	
		(mgd)	(afy)	(mgd)	(afy)
CWRF	City	4	4,480	4	4,480
MWRF[2]	VWD	3	3,360	5	5,600
GWRP[3]	LWWD	0.75	840	0.75	840
Total (Peak)		**7.75**	**8,680**	**9.75**	**10,920**

Notes:
(1) VWD: Vallecitos Water District; LWWD: Leucadia Wastewater District; VID: Vista Irrigation District.
(2) CMWD's allocation is 3.0 mgd in the summer and 2.0 mgd in the winter. Allocation for the Olivenhain Municipal Water District is between 1.0 mgd and 1.5 mgd depending on available flow. Based on the design capacity of 5.0 mgd, there is spare capacity of 0.5 mgd. However, due to insufficient wastewater flows, the actual available flow of the plant is currently limited to about 3.4 mgd. Some of the spare capacity is required for transportation of solids.
(3) CMWD's allocation for the La Costa Resort and Spa Golf Course is 0.75 mgd; however, peak historic usage is typically around 0.4 mgd. This supply is not connected to CMWD's main recycled water system.

It should be noted that GWRP only serves the south course of La Costa Resort and Spa and is not connected to the rest of CMWD's recycled water distribution system. The Meadowlark WRF operates as a "skimming" plant and extracts raw wastewater upstream in the joint system while the Carlsbad WRF and Gafner WRP treat secondary effluent from the EWPCF.

More details on CMWD's recycled water supplies are provided in Chapter 4 of this RWMP.

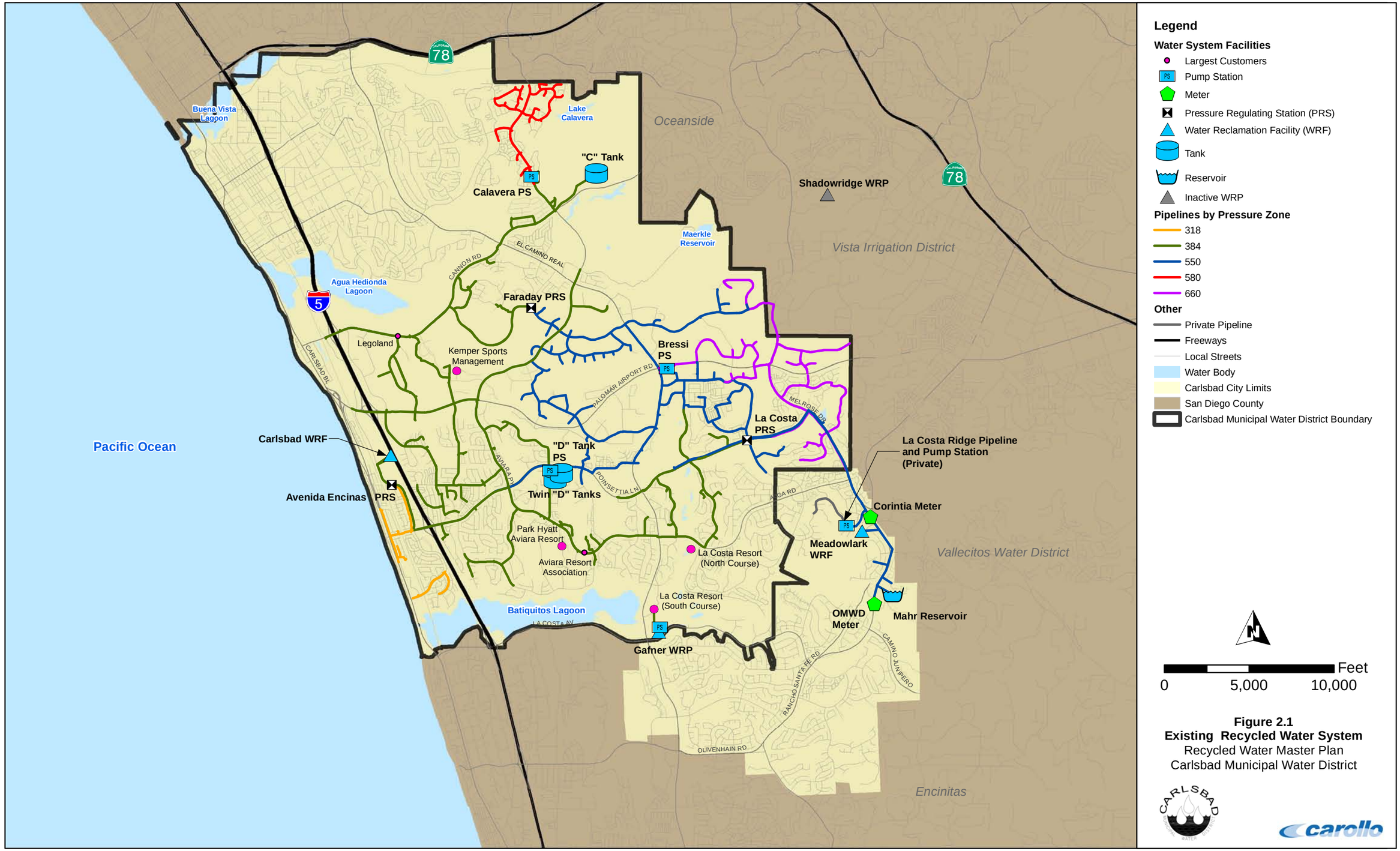


Figure 2.1
Existing Recycled Water System
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 5/10/2011 FILENAME: c:\pw_working\projectwiselwang\d0102644\Figure_2_1 Existing System Ver B.mxd

This page intentionally left blank.

2.4 EXISTING RECYCLED WATER CUSTOMERS

Recycled water delivery records were compiled and the average annual demands for the past seven years are summarized by use type in Table 2.2.

Table 2.2 Existing and Historical Recycled Water Demands
Recycled Water Master Plan
Carlsbad Municipal Water District

	Average Annual Demand[1] (afy)						
Usage Type	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Agricultural Irrigation (Flower Fields)	0	0	0	0	0	0	23
Commercial or Industrial Process Water	0	0	0	0	0	0	0
Landscape Irrigation							
Commercial Property Irrigation (includes Apartments)	382	427	410	561	827	1,074	637
Community (Churches, etc.)	8	9	11	13	17	27	49
Golf Courses	596	703	713	780	1,036	1,133	1,033
Highways	52	52	31	46	28	25	11
HOAs	388	468	645	1,087	1,361	1,466	1,369
Resort Property Irrigation	331	313	275	340	339	340	195
Parks	56	50	76	111	167	195	69
Schools	36	42	35	66	107	85	91
Other							
Construction[2]	0	0	1	32	0	3	0
Public Works[3]	0	0	2	2	2	2	40
Total	**1,849**	**2,064**	**2,199**	**3,038**	**3,884**	**4,350**	**3,517**

Notes:
(1) Demand from consumption records. Water loss information was not available and not included.
(2) Temporary recycled water customers were primarily construction water and are tabulated separately in billing records (some of CMWD's summaries of annual demand data may not include this demand category).
(3) Includes street medians, pump station sites, etc.

As shown in Table 2.2, CMWD's total demand has steadily increased between 2004 and 2009 due to the implementation of Phase II and the connection of new customers. However, in 2010 the demand reduced significantly. The reasons for the reduction are discussed in more detail in Chapter 3, but include the recent economic downturn, increases in recycled water rates, increased conservation (efficiency), watering restrictions associated with potable water, and cooler than average weather.

Table 2.2 also shows that CMWD serves most of its recycled water to the Home Owners Associations (HOAs), Golf Courses, and Commercial Properties for landscape irrigation. Table 2.3 lists the demands for CMWD's five largest users. Note that some of the demand associated with each of the five largest users may be considered multiple use types.

Table 2.3 Largest Existing Recycled Water Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

	Average Annual Demand (afy)						
Customer Name	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
La Costa Resort - North Course	167	273	287	178	263	335	272
La Costa Resort - South Course(1)	239	262	250	278	193	198	146
Park Hyatt Aviara Resort(2)	319	298	265	328	320	325	266
Aviara Resort Association	190	168	176	185	184	195	159
Kemper Sports Management(3)	0	0	0	139	396	405	274
Legoland	141	170	141	129	122	137	104
Total Top 5 Users	**1,056**	**1,171**	**1,119**	**1,237**	**1,478**	**1,595**	**1,221**

Notes:
(1) Supplied by Gafner WRP, not connected to the rest of the recycled water distribution system.
(2) Named the Four Seasons Resort prior to June 21, 2010.
(3) This user represents the golf course "The Crossings at Carlsbad".

As seen by comparing Table 2.3 to Table 2.2, CMWD's five largest customers comprise over one-third of the total demand for 2009 and 2010. As shown, the decline in the overall system demands is also seen in the five largest users. The locations of CMWD's five largest recycled water customers are shown on Figure 2.1.

2.5 RECYCLED WATER DISTRIBUTION SYSTEM

CMWD supplies recycled water through two recycled water distribution systems. CMWD's primary recycled water distribution system consists of five pressure zones, three storage tanks, three booster pumping stations, two supply sources with pump stations, and three pressure regulating stations. CMWD also supplies recycled water to the south course of the La Costa Resort and Spa from the Gafner WRP through a separate distribution system with dedicated service to the La Costa Resort and Spa. Table 2.4 provides a summary of each of the facilities within the two distribution systems, while Figure 2.2 illustrates the connectivity of the various facilities within the distribution system in a hydraulic profile format.

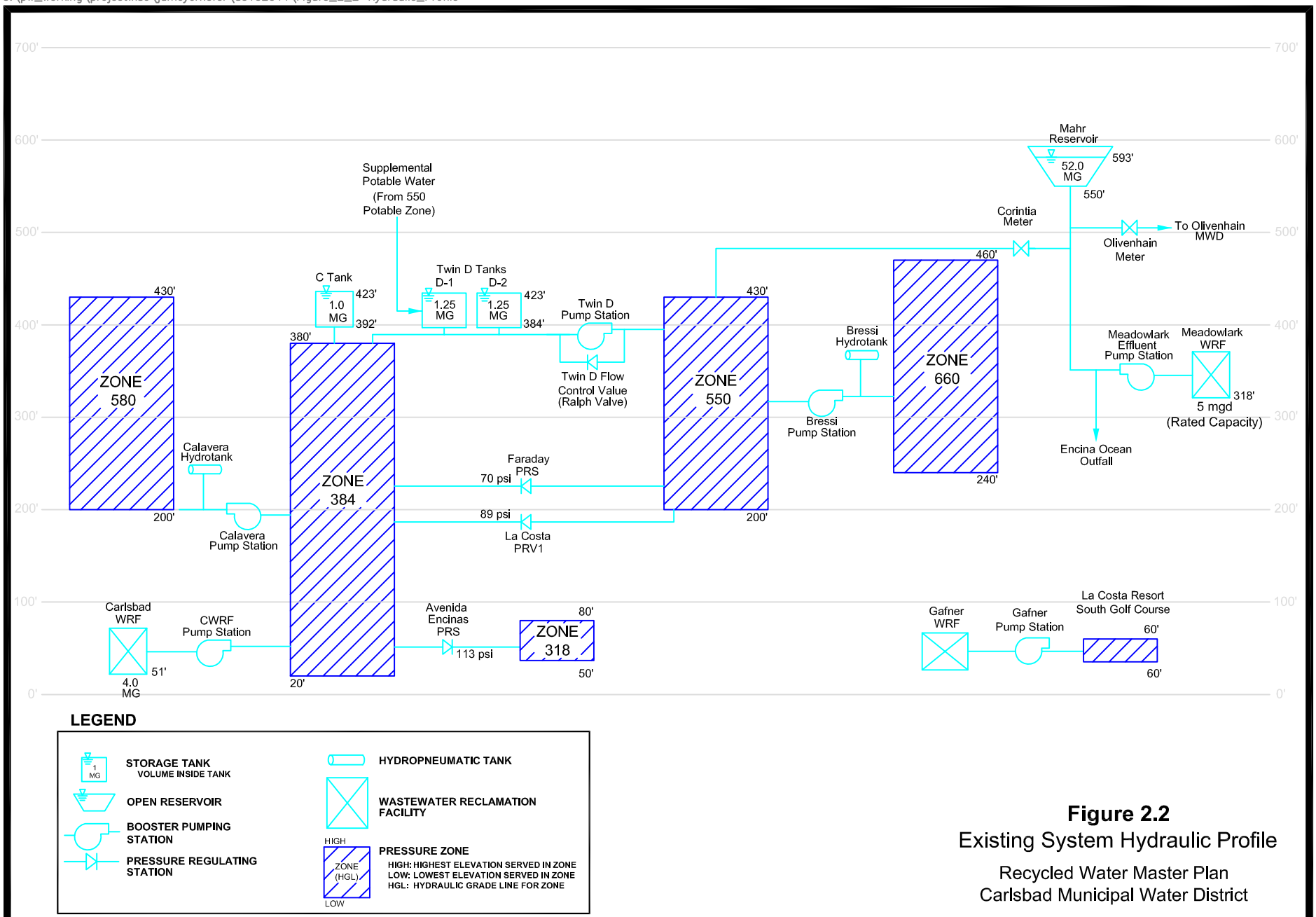
Table 2.4 Summary of Facilities by Pressure Zone
Recycled Water Master Plan
Carlsbad Municipal Water District

Pressure Zone HGL	Elevations Served (ft MSL)	Pumping Stations / Supply Sources(5)	Storage(5)	Pressure Regulating Stations	Annual Demand(6) (afy)
660	240' to 460'	Bressi PS(4)		n/a	311
580	200' to 430'	Calavera PS(4)		n/a	229
550	200' to 430'	Twin D PS MWRF(2)	Mahr Reservoir		731(1)
384	20' to 380'	CWRF	Twin D Tanks C Tank	Faraday PRV La Costa PRV Twin D FCV(3)	2,381
318	50' to 80'	n/a	On-site ponds	Encinas PRV	39
Gafner	60'	GWRP	On-site ponds	n/a	194

Notes:
PS = Pump Station; HT = Hydro-pneumatic Tank; PRV = Pressure Reducing Valve;
PSV = Pressure Sustaining Valve.

(1) Does not include 13.3 afy of demand served in Vallecitos Water District's service area.
(2) Flow from MWRF enters CMWD's system through the Corintia Meter, which measures the amount of flow provided from MWRF and Mahr Reservoir.
(3) Twin D FCV is also referred to as Ralph Valve. The valve is a combination rate of flow, pressure sustaining, and solenoid control valve, but is controlled by SCADA based on tank level and demand.
(4) Pump station includes a hydro-pneumatic tank; pressure zone supplied by this pump station does not include gravity storage.
(5) Supply Sources and Storage indicate facilities that are either located in or directly feed the identified zone. Note that pressure zones utilize storage and supply sources in other pressure zones. See Figure 2.2 for a schematic presentation of the connectivity of zones.
(6) Based on year 2008 and obtained from the hydraulic model (see Table 6.1).

C:\pw_working\projectwise\jdmeyerhofer\d0102644\Figure_2_2-Hydraulic_Profile



LEGEND

- STORAGE TANK (VOLUME INSIDE TANK)
- OPEN RESERVOIR
- BOOSTER PUMPING STATION
- PRESSURE REGULATING STATION
- HYDROPNEUMATIC TANK
- WASTEWATER RECLAMATION FACILITY
- PRESSURE ZONE
  - HIGH: HIGHEST ELEVATION SERVED IN ZONE
  - LOW: LOWEST ELEVATION SERVED IN ZONE
  - HGL: HYDRAULIC GRADE LINE FOR ZONE

Figure 2.2
Existing System Hydraulic Profile

Recycled Water Master Plan
Carlsbad Municipal Water District

carollo

2.5.1 Pipelines

CMWD's recycled water distribution system includes approximately 77 miles of pipelines within its service area, ranging in size from 2 to 30 inches in diameter. Table 2.5 presents a breakdown of pipelines by diameter and material type as of September 2009.

Table 2.5 Recycled Water Distribution System Pipelines
Recycled Water Master Plan
Carlsbad Municipal Water District

Diameter (in)	Pipeline Length[(1)] (ft) by Material Class					Total (ft)	Total (mi)
	PVC	ACP	CML&C STL	DIP	HDPE		
2	200	0	0	0	0	200	<0.1
4	28,400	0	100	0	0	28,500	5.4
6	27,400	1,500	1,200	2,200	0	32,300	6.1
8	137,500	400	1,600	1,300	0	140,800	26.7
10	6,500	100	0	0	0	6,600	1.3
12	84,500	10,800	2,100	10,700	0	108,100	20.5
14	0	0	4,600	2,700	0	7,300	1.4
16	8,600	0	200	900	0	9,700	1.8
18	8,200	0	500	8,300	0	17,000	3.2
20	4,500	0	3,500	0	0	8,000	1.5
24	0	0	22,800	0	50	22,850	4.3
27	0	0	4,800	0	0	4,800	0.9
30	0	0	19,300	1,300	50	20,650	3.9
Total (ft)	**305,800**	**12,800**	**60,700**	**27,400**	**100**	**406,800**	-
Total (mi)	**57.9**	**2.4**	**11.5**	**5.2**	**<0.1**	-	**77.0**

Notes:
PVC = polyvinyl chloride; ACP = asbestos cement pipeline; CML&C STL = cement mortar lined and coated steel; DIP = ductile iron pipeline; HDPE = high density polyethylene.
(1) All lengths are rounded to 100 feet (except for HDPE, which is rounded to the nearest 50 feet for consistency with categorization of Table 2.6). Data is from CMWD's pipeline GIS layer as of September 2009.

As shown in Table 2.5, the majority of CMWD's transmission and distribution mains consist of 8-inch diameter to 12-inch diameter pipelines (63 percent). The majority of the pipelines (about 75 percent) are made of polyvinyl chloride (PVC).

According to CMWD's pipeline GIS layer as updated September 2009, approximately 59 percent of the recycled water distribution system pipelines were installed in the years 2000 through 2009, with less than one percent installed prior to 1985. Figure 2.4 summarizes the pipeline lengths by installation years while Table 2.6 summarizes the length of pipeline by material and installation year.

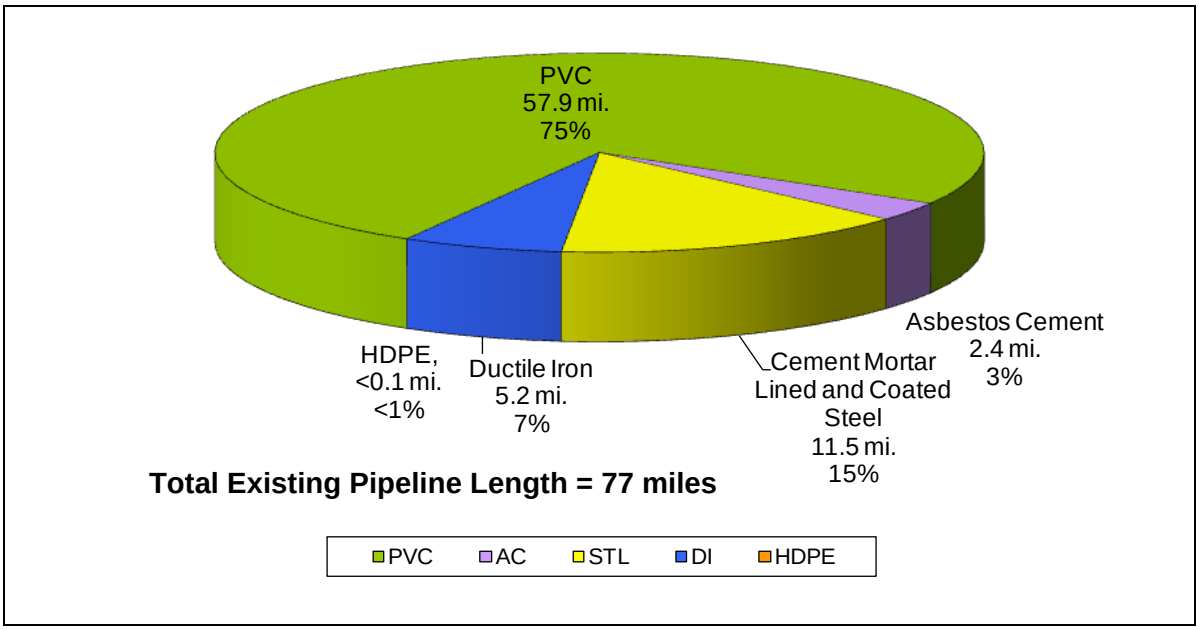


Figure 2.3 Pipelines by Material Type

Table 2.6 Pipelines by Installation Year and Material Type
Recycled Water Master Plan
Carlsbad Municipal Water District

Material	Pipeline Length[1] (ft) by Installation Year[2]					Total (ft)	Total (mi)
	Prior to 1985	1985 to 1994	1995 to 1999	2000 to 2004	2005 to 2010		
PVC	800	33,800	77,000	174,400	19,800	305,800	57.9
ACP	100	8,400	500	3,800	0	12,800	2.4
CML&C STL	2,900	6,800	18,500	32,500	0	60,700	11.5
DIP	0	10,900	7,300	9,200	0	27,400	5.2
HDPE	0	0	0	100	0	100	<0.1
Total (ft)	**3,800**	**59,900**	**103,300**	**220,000**	**19,800**	**406,800**	
Total (mi)	**0.7**	**11.3**	**19.6**	**41.7**	**3.8**		**77.0**

Notes:
PVC = polyvinyl chloride; ACP = asbestos cement pipeline; CML&C STL = cement mortar lined and coated steel; DIP = ductile iron pipeline; HDPE = high density polyethylene.
(1) All lengths are rounded to nearest 100 feet. Data is from CMWD's pipeline GIS layer as of September 2009.
(2) Installation Year based on construction plan signature date from CMWD's GIS layer.

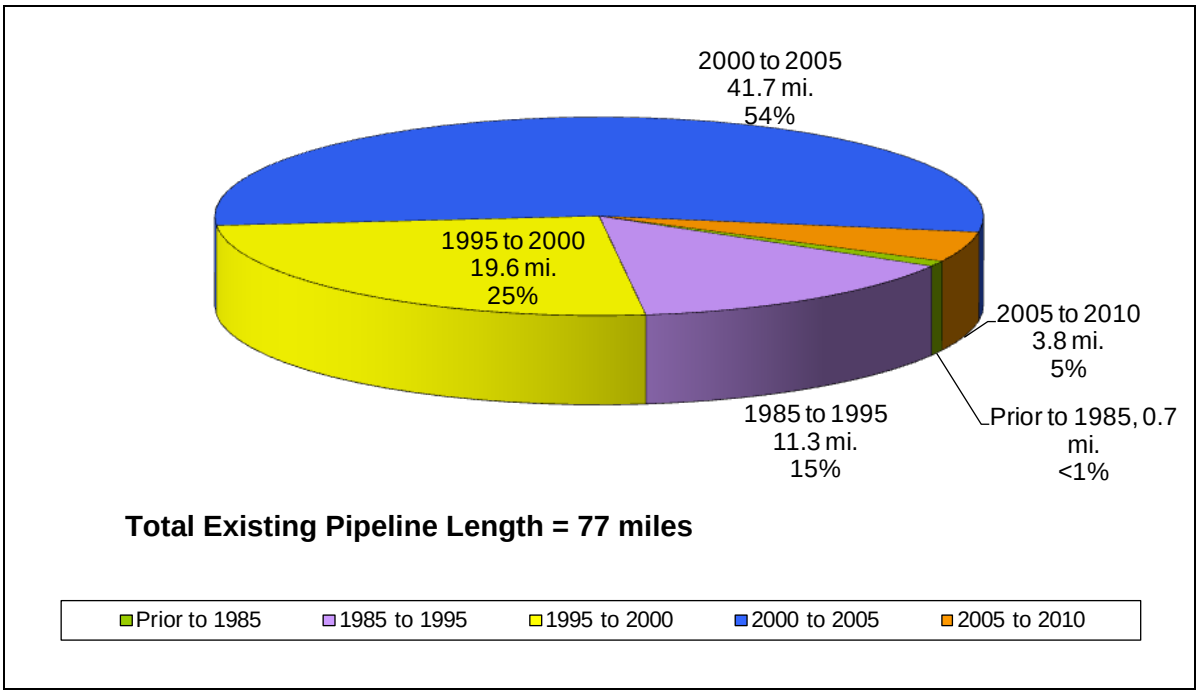


Figure 2.4 Pipelines by Installation Year

2.5.2 Pumping Stations

CMWD's recycled water distribution system contains four pump stations, one delivering flow from CWRF and three pump stations that move water within the distribution system between pressure zones. In addition, VWD uses a pump station to deliver water from MWRF to Mahr Reservoir and LWWD uses a pump station to deliver water from GWRP to a lake for irrigation of the La Costa Resort and Spa south golf course. Table 2.7 lists details for each pump station.

The **Bressi PS** is the sole conveyance of recycled water into Zone 660, and consists of three main pump units and a small 180-gpm jockey pump with a 7.5-hp motor. The Bressi PS contains a hydro-pneumatic tank, which provides pressure while the pump units are inactive.

The **Calavera PS** is the sole conveyance of recycled water into Zone 580, and consists of three main pump units and a small 50-gpm jockey pump unit with a 5-hp motor. This pump station contains a hydro-pneumatic tank, which in conjunction with the jockey pump provides pressure while the three main pump units are inactive and demand is low.

The **Twin D PS** is located at the site of the Twin D Tanks, and consists of four pump units pumping from Zone 384 to Zone 550. This pump station is designed to supply the upper zones of CMWD's recycled water system from Carlsbad WRF if supply from Meadowlark WRF is unavailable. The pump station is capable of conveying flow through the Corintia Meter into Mahr Reservoir.

Table 2.7 Pumping Stations
Recycled Water Master Plan
Carlsbad Municipal Water District

Pump Station	No. of Pump Units	Year of Installation	Suction Zone or Facility	Discharge Zone	Design Capacity (gpm)
Bressi PS	3 + JP[(1)]	2006	Zone 550	Zone 660	3,000
Calavera PS	3 + JP[(1)]	2004	Zone 384	Zone 580	1,800
Twin D PS	4	2003	Zone 384	Zone 550	4,500
CWRF PS	3	2002	CWRF	Zone 384	10,000
MWRF PS[(2)(3)]	3	2005	MWRF	Zone 550[(1)]	3,250
GWRPS[(4)]	2	1991	GWRP	La Costa South Golf Course	2,250

Notes:
(1) Bressi PS and Calavera PS include jockey pump units for low flow conditions.
(2) This pump station feeds Zone 550 and through the Corintia Meter it can also feed Mahr Reservoir.
(3) Owned and operated by VWD.
(4) Owned and operated by LWWD.

The **Carlsbad WRF PS** is located at the Carlsbad WRF and consists of three pump units that pump into Zone 384. The pump units are sized at 3,330 gpm each. The pump station design flow of 10,000 gpm requires simultaneous operation of all three pump units. Two empty pump bays provide space for future expansion of the pump station.

Meadowlark WRF PS consists of three variable frequency drive vertical turbine pump units. This pump station is not a part of CMWD's recycled water system and is owned and operated by VWD. This pump station feeds the Zone 550 through the Corintia Meter and is designed to pump to Mahr Reservoir.

Gafner WRP PS delivers recycled water to the La Costa Resort and Spa south golf course lake. It includes two 1,125-gpm pumps with 40-hp motors, one operating pump, and one standby pump. Water is pumped through a 12-inch diameter pipeline to the lake.

Chapters 6 and 7 contain additional details for each facility and provide a discussion on the controls used to operate each facility.

2.5.3 Pressure Regulating Stations

Pressure regulating stations (PRS) allow distribution systems to transfer water from higher pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely draining the pressure out of the higher zone. Typically, a PRS contains pressure reducing valves (PRV), pressure sustaining valves (PSV), pressure relief valves, or combination valves.

A PRV conveys water from an upper zone to a lower zone while reducing the pressure to a specified pressure setting on its downstream side. A PSV maintains a pressure setting on its upstream side while conveying flow. That is, the pressure sustaining valves will not allow water to transfer into the lower pressure zone if the pressure in the upper zone drops below a certain level. This ensures that a main break, or similar emergency, in the lower pressure zone does not drain too much water from the upper pressure zone. CMWD uses combined valves, which incorporate both pressure reducing and pressure sustaining features.

Pressure relief valves bleed water from areas of high pressure when pressure exceeds a certain threshold. CMWD's pressure regulating stations are configured to discharge from the lower pressure to atmosphere or into the storm drain if the pressure in the lower pressure zone gets too high.

CMWD's recycled water distribution system contains three pressure regulating stations, which generally convey and regulate the flow of water from higher pressure zones to the lower zones. Table 2.8 summarizes details of each PRS. The locations of the pressure regulating stations are shown on Figure 2.1, while the connectivity is shown on Figure 2.2.

Table 2.8 Pressure Regulating Stations
Recycled Water Master Plan
Carlsbad Municipal Water District

Name	No. of Valves(1)	Year of Installation	Upstream Zone	Downstream Zone	Elevation (ft MSL)	Setting (psi)
Faraday PRS(3)	3	2003	550	384	220	70
La Costa / Poinsettia PRS(3)	3	2006	550	384	175	89
Twin D Flow Control Valve(2)(Ralph Valve)	2	2003	550	384	386	13
Avenida Encinas PRS(3)	2	2001	384	318	58	113

Notes:
(1) Each pressure regulating station includes a pressure relief valve (the Twin D PS also includes a pressure relief valve). The number of valves includes the pressure relief valve.
(2) The pressure regulating station at the Twin D PS acts as an altitude valve, replenishing the Twin D Tanks from the MWRF and Mahr Reservoir via the Corintia Meter. The valve is a combination rate of flow, pressure sustaining, and solenoid control valve, but is controlled by SCADA based on tank level and demand.
(3) A PSV sustains a set pressure upstream of the valve, while a PRV maintains a set pressure downstream of the valve. CMWD uses combination pressure reducing and pressure sustaining valves with dual pilot controls at its pressure regulating stations.

As shown in Table 2.8, the Faraday PRV, La Costa PRV, and Twin D PSV supply Zone 384 from Zone 550. These three regulating stations are typically operated to deliver flow from Meadowlark WRF and Mahr Reservoir via the Corintia Meter. The Avenida Encinas PRV is the sole conveyance to Zone 318, regardless of the supply source and operating conditions.

2.5.4 Corintia Meter

CMWD's distribution system contains a metering station at the Carlsbad WRF and a metering station, the Corintia Meter, at the delivery point to CMWD's distribution system from VWD's Meadowlark WRF and Mahr Reservoir. The Corintia metering station consists of a 16-inch diameter magnetic meter (magmeter) to record flow. There is a 16-inch diameter plug valve downstream from the meter that can either be opened or closed. This valve is normally open such that Zone 550 floats off Mahr Reservoir. However, the valve can be closed under certain conditions to isolate CMWD's recycled water distribution system from VWD and Olivenhain Municipal Water District's (OMWD) recycled water distribution systems. The Corintia Meter is located in an underground vault near the intersection of Melrose Drive and Corintia Street as shown on Figure 2.1.

2.5.5 Interconnections

CMWD's recycled water distribution system currently does not have any emergency interconnections with recycled water distribution systems of neighboring agencies. However, the OMWD recycled water distribution system is also connected to Mahr Reservoir and fed entirely by the Meadowlark WRF. Since the OMWD recycled water distribution system does not have an additional source of supply, OMWD would not be able to supply CMWD's recycled water distribution system in the event of an outage of Meadowlark WRF. However, CMWD could supply OMWD's recycled water distribution system from Carlsbad WRF via CMWD's recycled water distribution system.

2.5.6 Potable Water Supply Connections

CMWD's recycled water distribution system currently has one connection from CMWD's potable water distribution system to the recycled water distribution system. Potable water is introduced to the recycled water distribution system at the D Tanks, through the use of an air gap. The connection is made up of a meter and an 8-inch diameter PSV currently set to 74 psi. According to CMWD staff, the PSV can convey at least 3,000 gpm. The valve is normally closed and can be operated remotely through SCADA.

VWD also has a potable water supply connection at Mahr Reservoir. Potable water can be added to the reservoir through an air gap.

2.5.7 System Operations

The primary function of CMWD's recycled water distribution system is to distribute recycled water from the water reclamation facilities to CMWD's customers.

The **Meadowlark WRF** operates as a skimming plant, reclaiming treated wastewater and discharging solids to EWPCF through a dedicated 6-inch diameter DIP forcemain to VWD's 24-inch diameter gravity outfall sewer. VWD operates the Meadowlark WRF PS to supply recycled water to the system. Flows from Meadowlark WRF depend on the influent flows to the treatment plant. The variation in influent flows to Meadowlark WRF, the diurnal variation

of CMWD's customer demands, and the diurnal variation of OMWD's customer demands cause water level changes on a daily basis in Mahr Reservoir. CMWD strives to maintain at least 15 feet of water in Mahr Reservoir to avoid pressure problems in Zone 550.

In the case where recycled water demand is low and Mahr Reservoir is full, tertiary treatment can be curtailed and secondary treated water can be pumped through a separate pumping station to a 12-inch diameter "failsafe" pipeline, which is capable of a peak flow of 3.0 mgd. The secondary treated pump station includes three duty (no standby) pumps rated at 920 gpm each and with a combined capacity of 1,750 gpm (2.5 mgd) with all three pumps operating.

The "failsafe" pipeline can also receive flow from the tertiary pumping station through manually operated valves.

According to the Mahr Reservoir Operations and Maintenance Manual (Carlsbad, 2008), 32 MG of storage within Mahr Reservoir is dedicated to CMWD's recycled water distribution system storage needs. This agreement is based on a supply from the Meadowlark WRF of 2.0 mgd during the winter (December through March) and 3.0 mgd during the summer (April through November).

The **Carlsbad WRF** treats secondary effluent from the EWPCF for delivery to CMWD's recycled water distribution system from the west side of the service area. Recycled water is supplied to CMWD's recycled water distribution system by the Carlsbad WRF PS. Under typical operations, the pump units are controlled by water levels in two of the Twin D tanks.

The Carlsbad WRF PS pulls from two reclaimed water basins totaling 7.5 MG of recycled water storage. However, a single basin with about 3.75 MG of storage is usually sufficient for operation of CMWD's existing recycled water distribution system. The basins have a dual purpose as these provide buffering capacity to handle peak wet weather flows tributary to the EWPCF during the winter months and provide additional storage to accommodate daily irrigation peaking during the summer months for CMWD.

As discussed in more detail in Chapter 3, CMWD's recycled water distribution system reaches its peak demands during the evening hours for nighttime irrigation. Based on discussions with CMWD staff, the typical daily operations pattern is as follows:

- When water levels in CMWD's storage reservoirs fall, the Carlsbad WRF PS comes online, supplying the nighttime demand from the Carlsbad WRF equalization basin and replenishing operational storage.
- As the Twin D tank levels fall, the Twin D Flow Control Valve (Ralph Valve) will open based on the levels in the Twin D tanks to increase the flow being taken from Meadowlark WRF and Mahr Reservoir via the Corintia Meter.
- The Carlsbad WRF PS is turned off based on the levels in the Twin D tanks once the tanks replenish as the nighttime irrigation demands end. However, during peak

months, the Carlsbad WRF PS will be run all night to take advantage of non-peak time-of-use electrical rates to lift supply from Carlsbad WRF to the storage tanks to avoid pumping during peak time-of-use electrical rates.

- The Twin D Flow Control Valve (Ralph Valve) is left active until the totalized flow through the Corintia Meter reaches the allotment for the day or the operational storage is replenished. After SCADA closes the Twin D Flow Control Valve (Ralph Valve), the distribution system is supplied from operational storage and is supplemented by the Carlsbad WRF, if necessary.

Recycled water demands in Zones 660 and 550 are typically supplied exclusively by Meadowlark WRF and Mahr Reservoir via the Corintia Meter throughout the day, as Zone 550 uses Mahr Reservoir for operational storage. In addition, some of the demands in Zone 384 are supplied from Meadowlark WRF and Mahr Reservoir when the Twin D Flow Control Valve, Faraday PRV, and La Costa PRV are open. The remaining demands in Zones 384, 318, and 580 are supplied from Carlsbad WRF. Once the daily allotment from Meadowlark WRF has been reached, the Twin D Flow Control Valve is closed.

If Meadowlark WRF and Mahr Reservoir are not able to supply the system, the flow direction can be reversed so that the Carlsbad WRF PS and the Twin D PS can supply the system.

Gafner WRP exclusively serves the La Costa Resort south golf course. The golf course provides limited operational storage through lakes within the golf course. Since the La Costa Resort is the only customer supplied by Gafner WRP, the pump station is controlled based on the demands of the golf course (via lake level).

2.6 ABANDONED FACILITIES

CMWD has also identified several abandoned pipelines within its potable water distribution system that may prove useful to convey recycled water. These pipelines are shown on Figure 2.5. Although the condition of these pipelines is unknown, CMWD staff has indicated that it may be possible to utilize some of these abandoned pipelines by inserting a smaller diameter pipeline within the existing abandoned pipeline such that the existing abandoned pipeline is used as a casing. Based on discussions with CMWD staff, the following two abandoned potable water pipelines should be considered when evaluating future system expansions of the recycled water distribution system:

- A 27-inch diameter pipeline along Palomar Airport Road and east of El Camino Real is abandoned and extends to the Santa Fe I Tank beyond the City boundary. The pipeline within the service area is approximately 1.9 miles in length. The currently abandoned potable water Santa Fe I Tank could potentially be utilized for storage for the recycled water system. However, portions of this pipeline have been destroyed.

Oceanside
Oceanside
Oceanside
Encinitas
Encinitas
Pacific Ocean
Buena Vista Lagoon
Agua Hedionda Lagoon
Batiquitos Lagoon
Lake Calavera
Buena Vista Reservoir and Tank (186' HWL)
"C" Tank
Calavera PS
Shadowridge WRP
Faraday PRS
"E" Tank (302' HWL)
Sante Fe I Tank (600' HWL)
Bressi PS
La Costa PRS
Carlsbad WRF
"D" Tank PS
Twin "D" Tanks
Avenida Encinas PRS
Corintia Meter
Meadowlark WRF
Mahr Reservoir
OMWD Meter
Gafner WRP
El Camino Real
Tamarack Ave
Aviara Pkwy
8"
6"
10"
10"
10"
14"
20"
20"
20"
20"
27"
12"
78
5

Legend

Recycled Pipelines by Pressure Zone
- 318
- 384
- 550
- 580
- 660

Recycled Water Facilities
- WRF
- Tank
- Reservoir
- Inactive WRP
- Meter
- Pump Station
- Pressure Regulating Station

Other
- Freeways
- Local Streets
- Carlsbad Municipal Water District Boundary
- Water Body
- Carlsbad City Limits
- San Diego County

Abandoned Potable Water Facilities
- 24" Abandoned Pipeline
- Abandoned Tanks

N

0 5,000 10,000 Feet

Figure 2.5
Abandoned Potable Water Facilities
Recycled Water Master Plan
Carlsbad Municipal Water District

CARLSBAD MUNICIPAL WATER DISTRICT

carollo

DATE: 5/10/2011 FILENAME: c:\pw_working\projectwise\lwang\d0102644\Figure_2_4-Abandoned Pipelines Ver B.mxd

This page intentionally left blank.

- A large number of 20-inch diameter pipeline segments with a combined length of approximately 5.3 miles along El Camino Real are abandoned and could potentially be rehabilitated or used to convey flow northwest towards the Rancho Carlsbad Golf Course.

In addition, the following storage reservoirs could potentially be converted to the recycled water system:

- **BV Tank** is a 10,000-gallon welded steel tank constructed in 1972, currently in use as a forebay for a potable water pump station located in the northeast quadrant at Buena Vista Way at James Drive. The tank is at ground elevation 223 feet above mean sea level (ft-msl) on a 2.8-acre parcel owned by the City of Carlsbad.
- **BV Reservoir** is an abandoned concrete lined open reservoir located in the northeast quadrant at Buena Vista Way at James Drive. The reservoir is approximately 310 feet by 120 feet at the top and 270 feet by 90 feet at the bottom with a base elevation of 180 ft-msl and a top elevation of 190 ft-msl. Overflow is approximately 186 ft-msl. Capacity is 1.4 MG. Utilization of this reservoir for storage of recycled water is limited, due to the residential nature of the neighborhood and potential odor problems.
- **E Tank** is a 1.5-MG reservoir located at the north end of Crossing Drive currently serving the potable water system. This reservoir sits at an elevation of 264 ft-msl with a high water line (HWL) at 302 ft-msl. The hydraulics of the zone it belongs to within the potable water system are such that the entire capacity of the reservoir is not able to be used. Due to its elevation, the only zone within the recycled water distribution system for which it could prove useful is on the west side of Interstate 5.
- **Santa Fe I Tank** is located east of CMWD's service area, north of Palomar Airport Road a little over a mile east of Melrose Drive. This reservoir is currently abandoned after it was replaced with a new potable water reservoir located along White Sands Drive called Santa Fe II. It is a 2.5-MG prestressed concrete tank at a hydraulic grade line of 660 ft-msl. Santa Fe I is connected to the 27-inch diameter abandoned potable water pipeline along Palomar Airport Road; however, portions of this pipeline have been destroyed.
- **Lake Calavera** is an open reservoir dam east of College Boulevard and south of Lake Boulevard. The primary function of the reservoir is stormwater retention and flood control. The water surface elevation is maintained at 208 ft-msl. The reservoir is able to operate between 190 ft-msl to 214 ft-msl, providing a storage volume of 480 MG. Currently, the reservoir water level is either drawn down to accommodate flood control needs or allowed to accumulate to increase surface elevation. In the future, the reservoir could potentially provide stormwater for a satellite treatment plant that would treat Lake Calavera water for distribution in the recycled water system.

The potential beneficial use of these abandoned potable water facilities and pipelines is evaluated as part of the future system analysis, which is discussed in Chapter 9.

2.7 KNOWN SYSTEM DEFICIENCIES

2.7.1 Limited Supply from MWRF

As discussed previously, the MWRF has a design capacity of 5.0 mgd, but currently supplies a maximum of about 3.4 mgd. The supply provided by the MWRF is limited to the upstream wastewater flow tributary to the MWRF plus wastewater diverted through VWD's Lift Station Number 1. This 3.4-mgd supply limitation has had an effect on the amount of recycled water being supplied to CMWD and OMWD as well as the flow to storage in Mahr Reservoir. MWRF is also limited by a 3.0-mgd "failsafe" pipeline. When the MWRF supply has been limited in the past, VWD has supplemented with potable makeup water supplied to Mahr Reservoir to meet OMWD demand.

2.7.2 Water Quality Issues at Mahr Reservoir

CMWD staff has noted water quality problems at Mahr Reservoir due to algae and other biological growth. To mitigate algae growth, the reservoir has an algae control chlorination system as well as an aeration and destratification system, which mixes the reservoir. In addition, sodium hypochlorite and/or copper sulfate are used to improve water quality.

2.7.3 Calavera Pump Station

Due to the limited storage and demand in Zone 580, the Calavera PS has experienced some operational and control issues. The pump units used to turn on frequently for short durations of time, either to replenish the 1,600-gallon hydro-pneumatic tank or meet low demands. Due to the hourly variability of demands, the pumps need to cycle on and off frequently. To mitigate this issue, CMWD recently installed a smaller 50-gpm capacity jockey pump that can run more continuously during the low demand hours and prevent the wear and tear on the large pump unit due to frequent on/off cycling.

2.7.4 Bressi Pump Station

CMWD staff noted that the Bressi PS experiences similar operational and control issues as Calavera PS. CMWD staff installed a 180-gpm capacity jockey pump to the Bressi pump station that can run continuously during the low demand hours and prevent the wear and tear on the large pump units due to frequent on/off cycling.

2.7.5 Gafner WRP

CMWD staff have stated that the aging nature of the Gafner WRP has led to a number of operational issues. The Gafner WRP exclusively serves the demand at the south golf course of the La Costa Resort and Spa. As the demand at the golf course is variable, the Gafner WRP has frequent startups and shutdowns that most likely exacerbate the operational issues that CMWD currently pays to resolve. In addition, the Gafner WRP is not optimally utilized since the south golf course demand is far less than the minimum amount of recycled water that CMWD is required to purchase from the LWWD. To further

compound the problem, the La Costa Resort and Spa further reduces recycled water demand to its south golf course by blending Gafner WRP effluent with potable water to decrease TDS concentrations for irrigation of golf course tees and putting greens. In the past, golf course tees and putting greens were irrigated with the same system as fairway sprinklers.

Discussions with the golf course operations manager of the La Costa Resort and Spa in 2010 indicated that they are planning on significant changes, which include reducing the amount of irrigated turf, and piping potable water directly to the greens and tees. These changes will further reduce their irrigation demand on the recycled water supply.

This page intentionally left blank.

RECYCLED WATER DEMANDS

3.1 INTRODUCTION

This chapter presents a discussion of the estimated recycled water demands on Carlsbad Municipal Water District's (CMWD) recycled water distribution system. CMWD's historical recycled water demand is presented first, followed by a discussion of the recycled water demand factors and peaking factors that are used to estimate the recycled water demands of potential future recycled water customers. This chapter is concluded with a discussion of the recycled water demand projections, which includes a summary of the evaluation of potential customers that was conducted as part of this Recycled Water Master Plan (RWMP). Demands for potential customers both inside and outside CMWD's service area are discussed. Details of each of the potential customers can be found in Appendix C.

3.2 BACKGROUND

As discussed in Chapter 2, CMWD's recycled water distribution system has been developed in phases. Planning for Phase I began in 1990, with CMWD's first recycled water master plan. Phase I was fully implemented by 1995 and planning for Phase II was initiated with the 1997 Master Plan Update. Table 3.1 presents details for each of CMWD's phases, along with the years of construction for major infrastructure associated with each expansion phase.

Table 3.1 Phases of Distribution System Expansion
Recycled Water Master Plan
Carlsbad Municipal Water District

Phase	Ultimate Yield (afy)	Major Elements Constructed	Years When Customers Were Connected	Number of Customers
Phase I	2,050	1993 - 1994	1993 - 1999	120(1)
Phase II(2)	2,950	2004 - 2009	2006 - 2010	242(3)

Notes:
(1) Based on Encina Basin Recycled Water Study (JPA, 2000).
(2) Connection of Phase II customers is ongoing. Based on input from CMWD staff, it is anticipated that the combined Phase I and Phase II goal of 5,000 afy will be met in 2012.
(3) Based on 362 total customers (675 meter accounts) in December 2010 billing data.

CMWD's agreement with Metropolitan Water District of Southern California (MWD) specifies targets for demands CMWD serves related to CMWD's eligibility for the Local Resource Program (LRP) contributions from MWD. The LRP contributions are paid to CMWD based on the actual demand served and range from $210 down to $100 per acre-foot served.

The targets are comprised of a Targeted Yield and a Maximum Annual Allowable Yield. The Targeted Yield is the minimum amount of recycled water that CMWD must serve within a subset of the period of agreement (the targeted yields and subsets are shown in Figure 3.1). The Maximum Annual Allowable Yield is the maximum amount of demand eligible for the LRP contribution in a given year. If CMWD does not reach the Targeted Yield within the subset of the period of agreement, the Maximum Annual Allowable Yield will be reduced. The Ultimate Yield is the Maximum Annual Allowable Yield for Fiscal Year 2008-09 and beyond (prior to Fiscal Year 2008-09, the Maximum Annual Allowable Yield increased each year until it reached the Ultimate Yield).

Figure 3.1 presents CMWD's Targeted and Maximum Annual Allowable Yields along with historical demands for the calendar years 2004 through 2010 based on customer billing data.

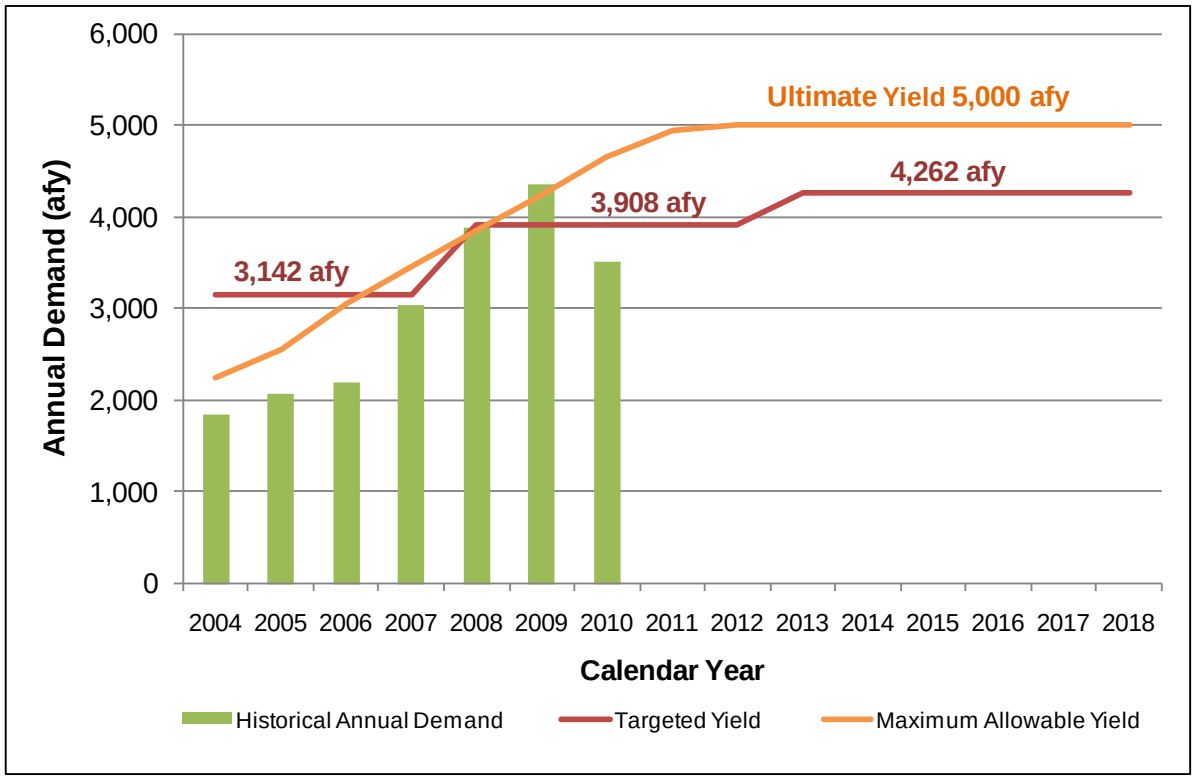


Figure 3.1 MWD Target and Ultimate Yield compared to Historical Demands

As shown in Figure 3.1, CMWD met the Targeted Yield in 2008 and 2009. This figure also shows that CMWD has maximized its LRP contribution in 2008 and 2009 by exceeding the Ultimate Yield. As shown in Figure 3.1, the demand in 2010 decreased from the demands seen in 2008 and 2009. It should be noted that the MWD agreements are based on fiscal year rather than calendar year, so the data shown in Figure 3.1 may not reflect actual historical comparisons between the demand served and the relevant targets. More details on the LRP agreement with MWD can be found in the original agreement document, which is included in Appendix D of this report.

3.3 HISTORICAL RECYCLED WATER DEMAND

CMWD's existing recycled water customers used a total of 3,517 acre-feet (3.1 mgd) in calendar year 2010. CMWD's average annual historical recycled water demands obtained from billing records for calendar years 2004 through 2010 are summarized in Table 3.2.

Table 3.2 Historical Recycled Water Demands
Recycled Water Master Plan
Carlsbad Municipal Water District

	Average Annual Demand[(1)] (afy)						
Usage Category	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Ag. Irrigation	0	0	0	0	0	0	23
Process Water	0	0	0	0	0	0	0
Landscape Irrigation							
Commercial Property Irrigation	382	427	410	561	827	1,074	637
Community Facilities	8	9	11	13	17	27	49
Golf Courses	596	703	713	780	1,036	1,133	1,033
Highways	52	52	31	46	28	25	11
HOAs	388	468	645	1,087	1,361	1,466	1,369
Resort Irrigation	331	313	275	340	333	340	195
Parks	56	50	76	111	167	195	69
Schools	36	42	35	66	107	85	91
Other							
Construction[(2)]	0	0	1	32	0	3	0
Public Works[(3)]	0	0	2	2	2	2	40
Total	**1,849**	**2,064**	**2,199**	**3,038**	**3,878**	**4,350**	**3,517**

Notes:
(1) Demand from consumption records. Water loss information was not available and not included.
(2) Temporary recycled water customers were primarily for construction water and are tabulated separately in billing records (some of CMWD's summaries of annual demand data may not include this demand category).
(3) Includes street medians, pump station sites, etc.

CMWD's current recycled water customers were divided into four categories of user types and ten sub-categories, each of which is listed in Table 3.2. As shown in Table 3.2, the landscape irrigation category represents the largest component of CMWD's demands. This reflects the current nature of CMWD's recycled water system customer base. CMWD currently does not have any non-irrigation usage type recycled water customers, but is planning to implement some non-irrigation usages in the near future.

3.3.1 Historical Demand Trends

The historical demands from 1992 through 2010 are shown on Figure 3.2.

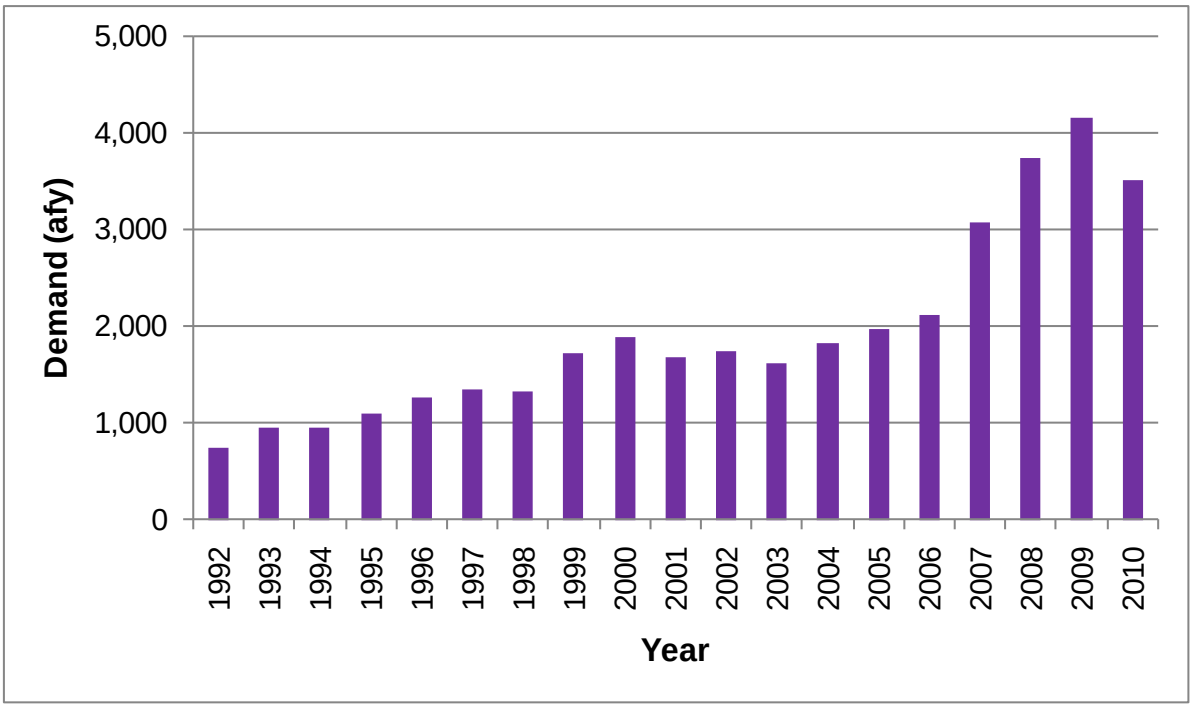


Figure 3.2 Historical Recycled Water Demands

As seen in Figure 3.2, CMWD's demands have grown consistently through year 2009, while demands decreased in 2010. Between 2004 and 2009, recycled water demands increased from 1,849 afy (1.7 mgd) to 4,350 afy (3.9 mgd), an increase of 235 percent corresponding to an average annual growth rate of about 19 percent. The primary reason for this growth trend between 2004 and 2009 is the extensive and continued efforts of CMWD to convert and connect new customers to the recycled water system. The growth between 2006 and 2008 was due to the efforts associated with the Phase II expansion of CMWD's recycled water system.

However, as shown in Figure 3.2, the annual demand decreased to 3,517 afy (3.1 mgd) in 2010. Several reasons are believed to contribute to the significant decline in 2010 demands, including higher than average precipitation in 2010, increased water conservation, CMWD staff's inspection and auditing practices, recent increases in recycled water rates combined with the economic downturn.

As presented in Table 3.3 and Figure 3.3, the same demand decrease in 2010 is observed for CMWD's five largest customers. This is noteworthy as it indicates a decline in recycled water usage by CMWD's largest users, such as La Costa Resort South Golf Course and Legoland, who have historically formed CMWD's base demand. Discussions between CMWD and some of its large recycled water customers clarified the demand reduction as

some of the customers indicated that they reduced recycled water usage through, for example, redesign of their golf courses or other irrigated areas by replacing irrigated turf with lower demand landscaping. In addition, some golf course customers indicated that they made adjustments to their irrigation practices to maintain water quality.

Table 3.3 Largest Existing Recycled Water Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Customer Name	Average Annual Demand (afy) 2004	2005	2006	2007	2008	2009	2010
La Costa Resort - North Course	167	273	287	178	263	335	272
La Costa Resort - South Course(1)	239	262	250	278	193	198	146
Park Hyatt Aviara Resort(2)	319	298	265	328	320	325	266
Aviara Resort Association	190	168	176	185	184	195	159
Kemper Sports Management(3)	0	0	0	139	396	405	274
Legoland	141	170	141	129	122	137	104
Total Top 5 Users	**1,056**	**1,171**	**1,119**	**1,237**	**1,478**	**1,595**	**1,221**

Notes:
(1) Supplied by Gafner WRP, not connected to the rest of the recycled water distribution system.
(2) Named the Four Seasons Resort prior to June 21, 2010.
(3) This user represents the golf course "The Crossings at Carlsbad".

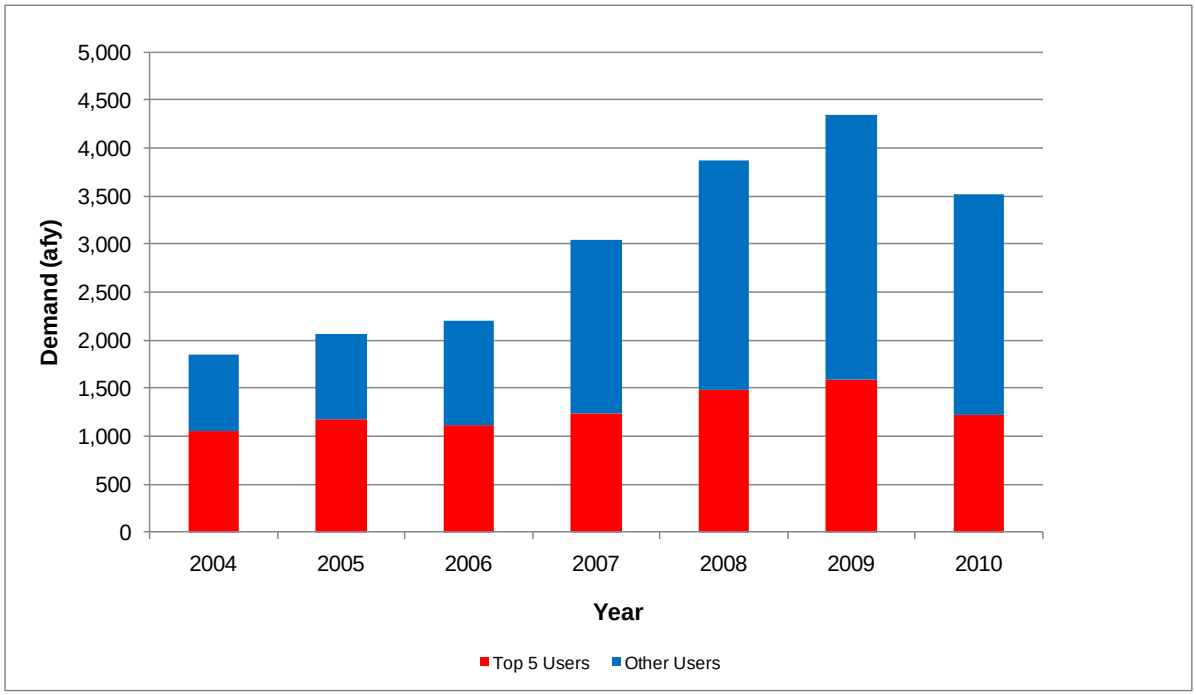


Figure 3.3 Existing Recycled Water Average Annual Demand

3.3.2 Existing Demand

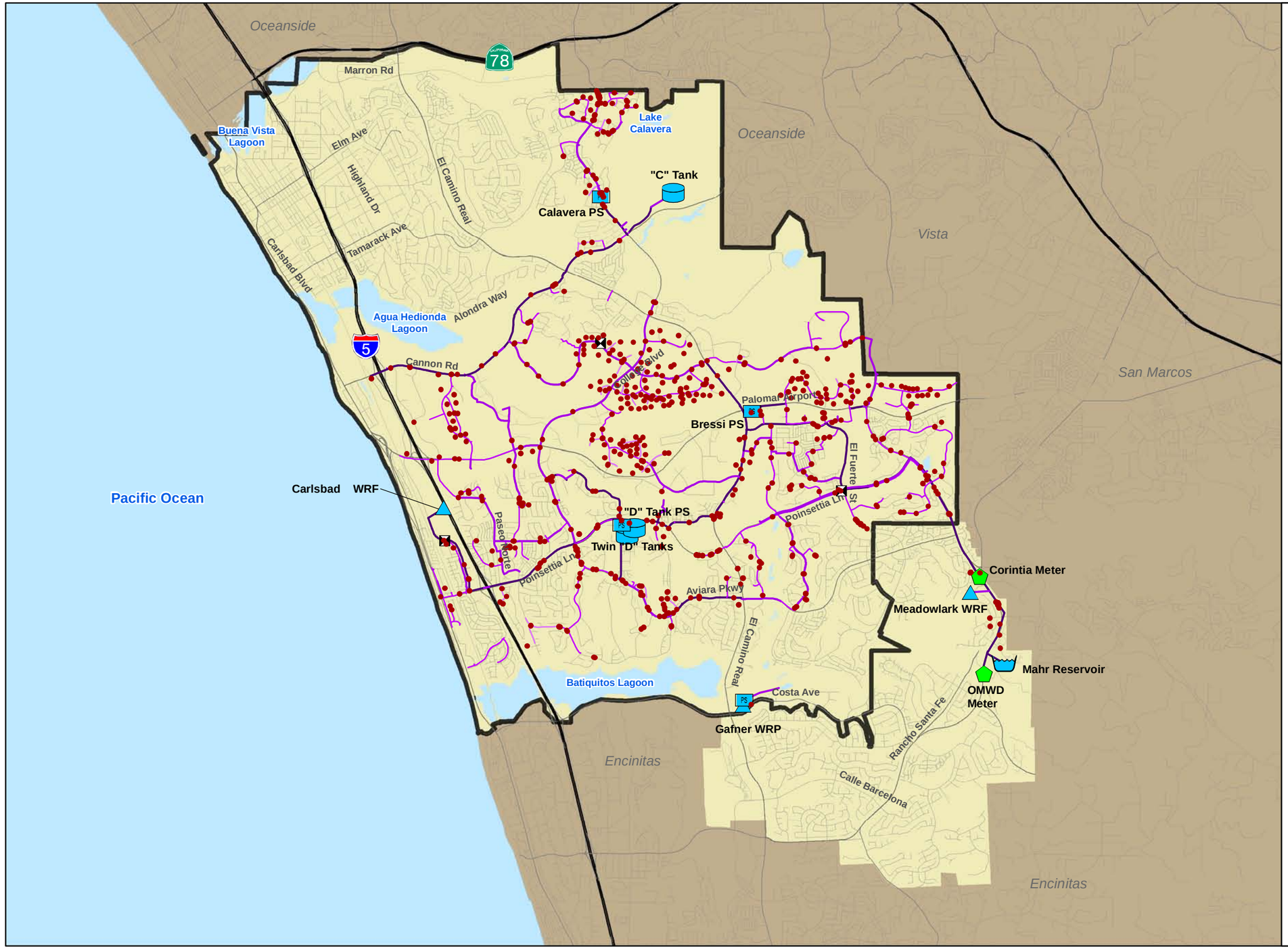
Locations for CMWD's existing recycled water customer meters (as of June 2009) are shown on Figure 3.4. As of December 2010, CMWD served approximately 362 customers through 675 meter accounts.

As discussed previously, CMWD's recycled water demand in year 2010 was 3,517 afy, which was a significant reduction of nearly 20 percent compared to the demand of 4,350 afy in 2009. As this reduction is most likely caused by several factors that are both temporary and permanent in nature, it was decided that neither the demand of 2009 nor 2010 would provide a good planning basis as the existing system demand.

Some of the temporary reasons that could have contributed to the demand decrease in 2010 include the absence of a hot summer and above average precipitation. Data from the California Department of Water Resources (DWR) confirms that the total precipitation in 2008 and 2009 were below average, while total precipitation in 2010, as well as 2011 year-to-date, were above average.

Other temporary factors include the economic downturn and the statewide water shortage conditions. Both conditions have resulted in increased water awareness and increased water conservation efforts for both potable and recycled water usage. It is anticipated that most of the water conservation efforts are more permanent in nature as some customers, such as the La Costa golf course, is undergoing a re-design to reduce the amount of irrigated turf. In addition, recent and future rate increases will continue to motivate customers to modify their landscaping and irrigation practices to conserve water and save cost on a permanent basis.

To establish a sound planning basis for the existing demand that is not based on extreme low year like 2010, but still takes permanent changes in water usage into account, the demands of the previous two years were evaluated in more detail. It was noted that when demands were compared from summer to summer rather than by calendar year, the demand in the period July 2009 through June 2010 (3,940 acre-feet) was very similar to the demand in the June 2010 through May 2011 (3,970 acre-feet). This shows that when the "dry" winter of 2009 is eliminated and two similar "wet" winters are compared, the demands were actually very consistent. Based on this observation and discussions with CMWD staff, it was decided to use 4,000 afy as the existing system demand.



Legend

Recycled Water Pipelines (by Diameter)
- Less than 6"
- 6" to 8"
- 10" to 14"
- 16" and larger

Existing Recycled Water Customer
- Existing Recycled Water Customer

Recycled Water Facility
- Pump Station
- Pressure Regulating Station (PRS)
- Meter
- WRF
- Tank
- Reservoir

Other
- Freeways
- Major Roads
- Local Streets
- Water Body
- Carlsbad City Limits
- San Diego County
- Carlsbad Municipal Water District Boundary

N

0 5,000 10,000 Feet

Figure 3.4
Existing Recycled Water Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 4/15/2011 FILENAME: c:\pw_working\projectwise\lwang\d0102644\Figure_3_03-Existing_Recycled_Water_Customers.mxd

This page intentionally left blank.

3.4 SEASONAL AND HOURLY PEAKING FACTORS

Peaking factors are used to estimate water demands for conditions other than average annual demand (AAD) conditions. Peaking factors were used to account for fluctuations in demands on a seasonal and hourly basis.

3.4.1 Seasonal Peaking Factor

As discussed previously, the makeup of CMWD's existing recycled water customer base is entirely irrigation in nature. During hot summer days, water use is typically higher than on a cold winter day because of increased irrigation demands. Common peaking factors include multipliers to scale AAD to Maximum Day Demand (MDD), Maximum Month Demand (MMD), and Minimum Month Demand (MinMD) conditions. In recycled water systems, the MDD factors are typically similar to MMD factors as irrigation sprinkler systems are often changed on a seasonal basis, rather than a daily basis, unless moisture sensors are used. Additionally, data for MDD conditions is difficult to estimate on a per user basis, since billing data is only collected monthly for each user.

Based on the historical data from CMWD, a maximum month peaking factor for irrigation customers was estimated. Table 3.4 displays a summary of historical information used in the development of a MMD peaking factor including the AAD and the MMD for years 2004 through 2009.

Table 3.4 Historical Seasonal Peaking Factors
Recycled Water Master Plan
Carlsbad Municipal Water District

Calendar Year	Average Annual Demand (mgd)	Maximum Month Demand (mgd)	MMD Peaking Factor	Individual Customers MMD Peaking Factor Range[(1)]
2004	1.65	3.27	2.0	1.1-2.5
2005	1.84	3.28	1.8	1.2-3.7
2006	1.96	3.24	1.7	1.1-4.8
2007	2.71	4.04	1.5	1.1-6.5
2008	3.46	5.34	1.5	1.2-6.0
2009	3.89	5.78	1.5	1.1-10.5
Average			**1.7**	

Note:
(1) In calculation of range of individual customers seasonal peaking factors, the following assumptions were made: minimum seasonal peaking factor excludes any accounts with seasonal peaking factors of zero (primarily inactive or closed accounts); maximum seasonal peaking factors are taken as the 95th percentile of all individual seasonal peaking factors to exclude erroneous factors, primarily from temporary accounts or large accounts being connected part way through a year.

Note that demands for La Costa Resort north and south courses were included in the demands shown in Table 3.4; thus, the supplies from Gafner WRP are factored into the calculation of seasonal peaking. If the La Costa Resort south course, and thus Gafner WRP, is excluded from the calculation, the average MMD peaking factor is 1.6.

Table 3.4 shows that MMD peaking factors range from 1.5 to 2.0 over the six-year period from 2004 to 2009. Variations for each year could be attributed to differing weather conditions and rainfall distribution. However, as shown in Table 3.4, the MMD has showed a decreasing trend over the last five years. This trend is most likely caused by the peak attenuation effect of increasing system size and number of customers. The effect of one or two large customer's water usage on the overall system demand decreases over time when more small and midsize customers are added. In addition, the smaller demand customers are typically less likely to adjust the timing of irrigation systems on a daily or weekly basis, but rather adjust irrigation times more on a seasonal basis.

Looking to the future, the decreasing trend appears be a sustained behavior rather than a temporary adjustment to drought conditions. Thus, it is recommended that the MMD peaking factor used in this study be based on the average factor of the six-year period, rather than the maximum value. Hence, a MMD peaking factor of 1.7 is used in this study for the existing and future system evaluations described in Chapters 8 and 9, respectively.

Table 3.4 also shows the MMD peaking factor for individual customers. The values demonstrate that seasonal peaking for some specific customers can be quite different in nature from the system as a whole, as some customers irrigate at a much higher level during the summer months than the system-wide average, while some customers irrigate more consistently throughout the year.

Figure 3.5 shows the monthly seasonal peaking factors for the calendar years 2004 through 2009. Weather data including the average daily high temperature for each month and the average monthly precipitation are also included on Figure 3.5 for reference. Weather record summaries were obtained from the Western Regional Climate Center (WRCC, 2010).

As shown in Figure 3.5, the seasonal peaking factor is generally highest in the month of August, but in some years is higher in the month of July or September. The seasonal peaking factor is highest in the summer due to the increased irrigation demands during periods of higher temperatures and less precipitation.

The months with minimum usage are most frequently January and February. The minimum seasonal peaking factor is used to calculate MinMD and is used primarily for water quality analysis. For this study, the minimum seasonal peaking factors were taken as the average of minimum seasonal peaking factors for each year, and were calculated to be 0.2, indicating that the average daily demand during MinMD conditions can be calculated as 20 percent of the AAD. Thus, the existing system MinMD demand can be calculated as 0.8 mgd.

If CMWD connects more customers from non-irrigation and non-weather dependent customers, such as industrial process or cooling towers, it is expected that the seasonal MMD peaking factor would decrease as these non-irrigation customers typically use a more constant amount of water throughout the year.

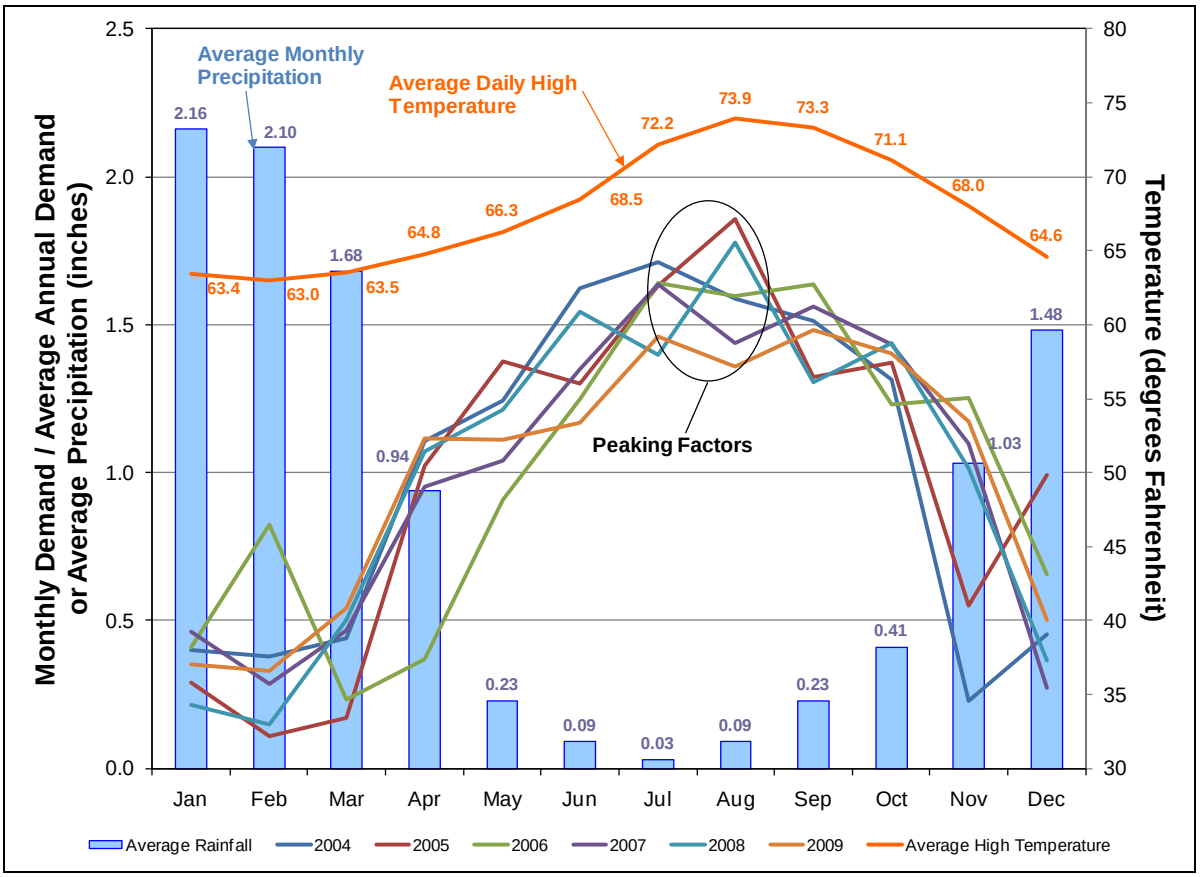


Figure 3.5 Recycled Water Peaking Factors by Month

3.4.2 Hourly Peaking Factors and Diurnal Curves

Regular variations in water demands also occur during a 24-hour period. Recycled water systems are characterized by substantial variations in demand during the day. Recycled water systems and areas that have substantial outdoor irrigation typically experience peak demand periods late at night through the early morning hours. This is especially true for CMWD's customers, as irrigation in publicly accessible areas without supervision is limited to the period between 10 p.m. and 6 a.m. in accordance with CMWD rules and regulations for the use of recycled water. This is in contrast with potable water systems with a significant residential component, which often experience two periods of peak use, the first in the morning between 6 a.m. and 8 a.m. and the second in the early evening between 5 p.m. and 8 p.m.

Since diurnal demand patterns for individual users can vary depending on their usage types, several usage-based diurnal demand patterns were developed from demand data gathered for the calibration portion of this study. Figure 3.6 through Figure 3.8 present the diurnal curves used in this study for the different types of irrigation customers. It is assumed that future irrigation customers will follow similar diurnal demand patterns.

The diurnal curve shown on Figure 3.6 represents a usage pattern of customers that irrigate for about 12 hours per day. This usage pattern represents golf course irrigation occurring during daytime hours. The diurnal curve shown on Figure 3.7 represents a usage pattern of customers that irrigate for a very short period in the late evening hours. Since the duration of irrigation is only about 3 hours per day, the peaking factor is 8.0. Figure 3.8 shows the estimated diurnal variation for typical users within the system. This diurnal curve was generated during the hydraulic model calibration and is discussed in further detail in Chapter 6.

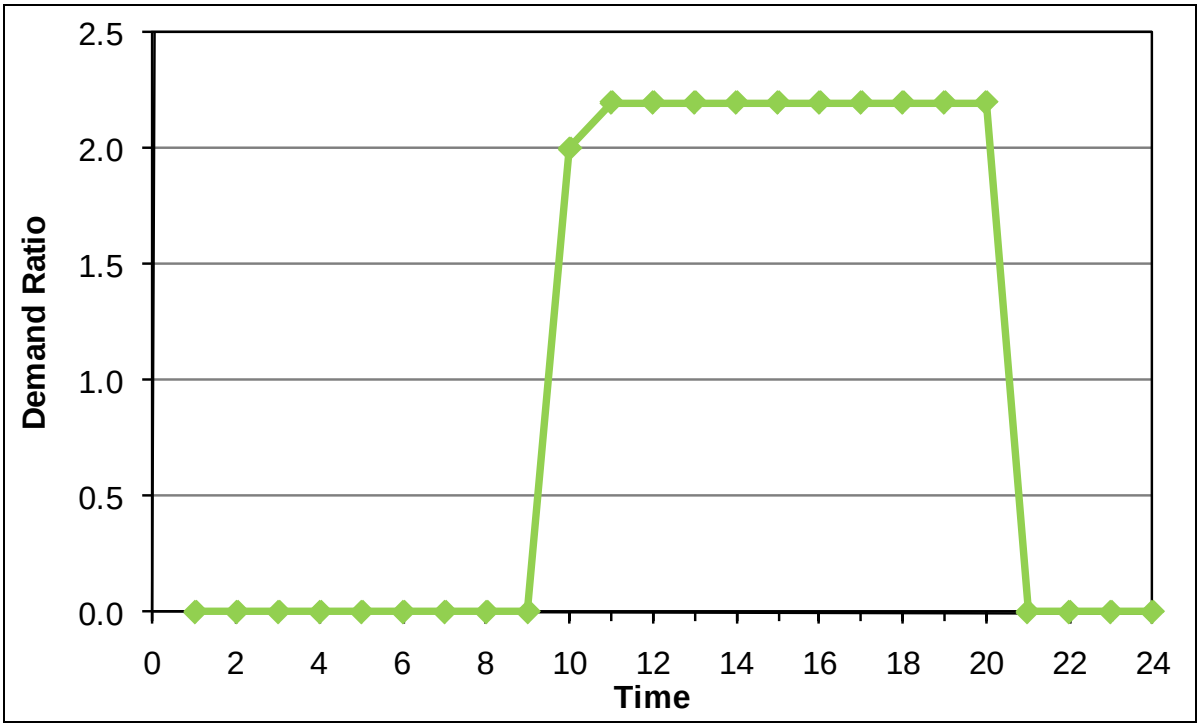


Figure 3.6 Daytime Irrigation

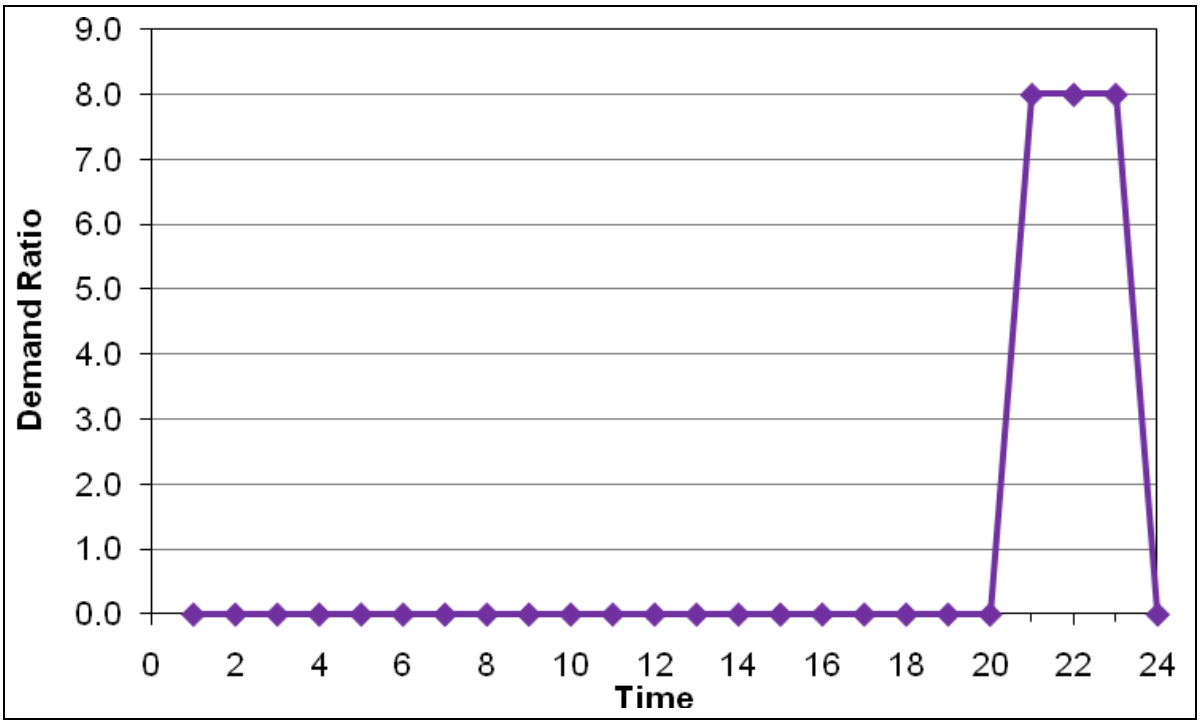


Figure 3.7 3-Hour Evening Irrigation

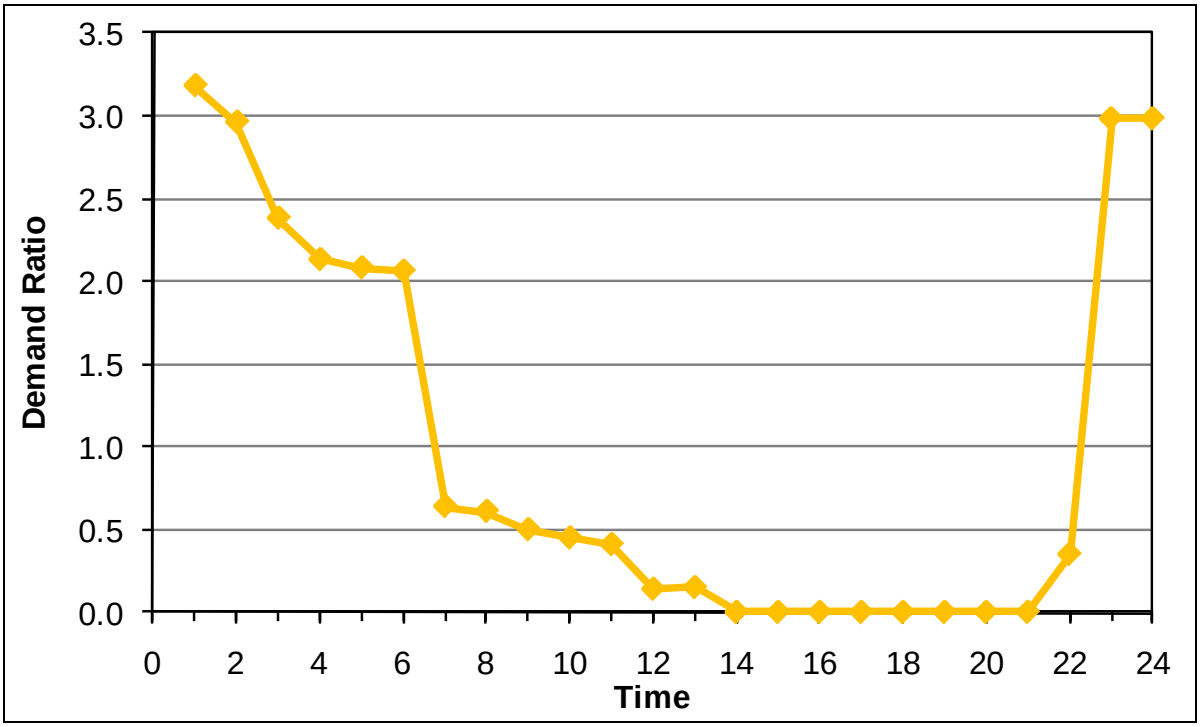


Figure 3.8 Other Irrigation Users

It should be noted that data on actual diurnal variation for individual customers was not gathered as a part of this study; rather these diurnal demand patterns were developed based on system-wide data and discussion with CMWD staff about specific users' hours of irrigation. Depending on the actual durations of irrigation, peaking factors for individual customers may be significantly higher, resulting in much more stress on the distribution system (i.e., if a customer irrigates for one hour instead of eight hours, the associated maximum hourly peaking factor for the day would be 24.0 rather than 3.0).

CMWD's Engineering Design Standards (CMWD, 2008) plan for usage of 8 hours per day (typically from 10 p.m. to 6 a.m.), resulting in a maximum hourly peaking factor for the day of 3.0. Within CMWD's distribution system, commercial and irrigation customers primarily use water for irrigation and would follow the irrigation based demand patterns.

CMWD may need to implement forms of demand management in the future to better utilize existing infrastructure while increasing the overall system demand. One way to decrease the maximum hourly peaking factor is to work with large customers to develop on-site storage capabilities, such as golf courses with lakes. These customers can take irrigation water during off-peak hours to replenish their on-site storage and pump from their storage facilities to meet peak demands without placing a peak demand on CMWD's distribution system.

3.4.3 Summary of Peaking Factors

A summary of the peaking factors used in this master plan is presented in Table 3.5.

Table 3.5 Peaking Factors
Recycled Water Master Plan
Carlsbad Municipal Water District

Demand Condition	Peaking Factor
Average Day Demand (ADD)	1.0 x ADD
Maximum Month Demand (MMD)	1.7 x ADD
Minimum Month Demand (MinMD)	0.2 x ADD
Peak Hour Demand	
8-hour irrigation	3.0 x MMD or 5.1 x ADD
3-hour irrigation	8.0 x MMD or 13.6 x ADD

3.5 RECYCLED WATER DEMAND PROJECTIONS

The future recycled water demand projections are based on a combination of a review of the existing recycled water customers and the identification of potential future recycled water customers. This section describes the methodology used to project the future demand potential including the customers identified in the customer database workshop, and concludes with a future demand summary.

It should be noted that the future demands described herein do not necessarily represent the actual future demands. This section is limited to identifying the future demand potential. The system analysis (see Chapter 9) determines the feasibility of serving these customers and identifies the preferred pipeline alignments to expand the existing recycled water system that will only serve a portion of the potential customers described in this chapter.

3.5.1 Methodology

To estimate CMWD's future recycled water demand, a list of potential recycled water customers was prepared using a combination of the following sources:

- Historical potable water billing records;
- Locations of parks and schools within the City's GIS as well as parks and schools within neighboring agencies near CMWD's boundary;
- Discussions with CMWD staff;
- Aerial photographs (which were searched for large, irrigated areas and business parks); and
- Studies from neighboring agencies:
  - Vista Irrigation District Water Reclamation Master Plan (CDM, 1993)
  - Vallecitos Water District 2002 Water, Wastewater, and Water Reclamation Master Plan Update (KJ, 2005)
  - Olivenhain Municipal Water District Northwest Quadrant Recycled Water Study (Boyle, 2004)

From this list, the most relevant potential users were included within the potential customer database. Phase III customers will then be selected from the customer database based on the expansions segments developed in Chapter 9. It should be noted that recent behavior changes by CMWD's customers have resulted in lower future demands than seen in historic billing records and previous demand estimates from planning documents. CMWD staff reviewed the demand projection for each potential customer and refined the overall demand estimates to be more consistent with the reduced demands seen more recently and local knowledge of CMWD's customer base.

In addition, planning summaries for future developments from the City's Planning Department were used to determine areas of potential development not included in the list of potential recycled water customers. Water demand factors for generic categories of recycled water usage were calculated from areas of development using historical demands. Ultimate demands were then projected by applying the water demand factors to the areas of potential development.

3.5.2 Potential Customers

Based on review of the available information and discussions with CMWD staff at the customer workshop, a list of 161 potential new large recycled water customers was developed. The customers were separated into the same seventeen categories and subcategories identified for the existing system, which are described in more detail below. These categories and subcategories are:

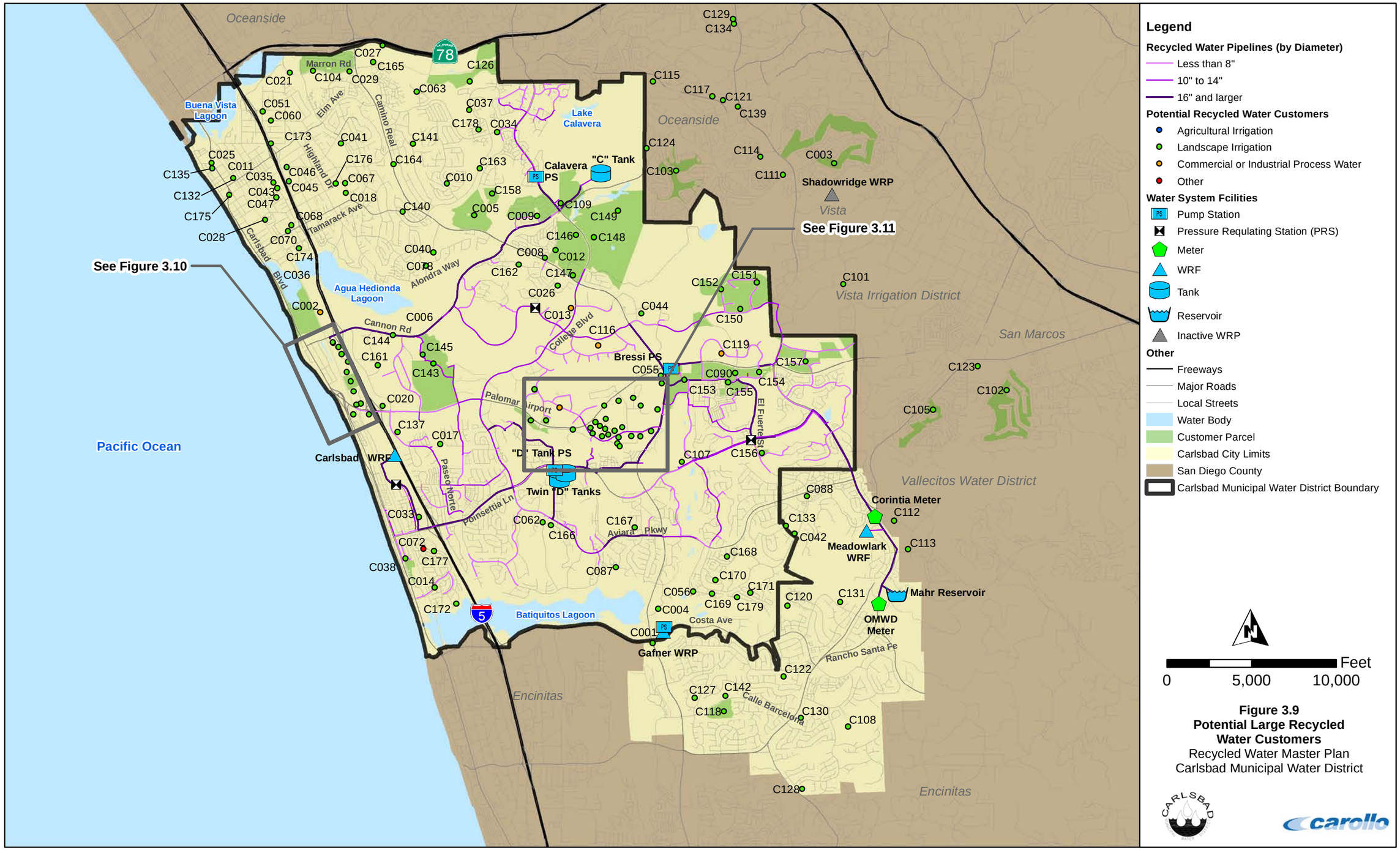
- Agricultural Irrigation
- Commercial or Industrial Process Water
  - Industrial
  - Commercial Cooling
- Landscape Irrigation
  - Commercial Property Irrigation
  - Community (Churches, etc.)
  - Golf Courses
  - Highways
  - Home Owners Association (HOA)
  - Parks
  - Resort Property Irrigation
  - Schools
- Other (Mobile Home Park, Public Works)
  - Construction
  - Public Works
  - Pond Evaporation

Note that some of these categories did not have any identified potential customers, but are included for consistency with the existing system customer base. The locations of these customers are shown on Figure 3.9 through Figure 3.11, while a detailed list with the estimated potential recycled water demand for each customer is listed in Appendix C.

It should be noted that the category Highway Irrigation is used in the existing recycled water system, but no potential customers were identified in this category.

Agricultural Irrigation

CMWD has several agricultural areas that could potentially be served with recycled water. Typically, the demands for this use are high and these connections are desirable. However, many of these agricultural areas within CMWD are temporary since HOAs and other developments are planned for these sites in the future.



Legend

Recycled Water Pipelines (by Diameter)
- Less than 8"
- 10" to 14"
- 16" and larger

Potential Recycled Water Customers
- Agricultural Irrigation
- Landscape Irrigation
- Commercial or Industrial Process Water
- Other

Water System Fcilities
- Pump Station
- Pressure Requlating Station (PRS)
- Meter
- WRF
- Tank
- Reservoir
- Inactive WRP

Other
- Freeways
- Major Roads
- Local Streets
- Water Body
- Customer Parcel
- Carlsbad City Limits
- San Diego County
- Carlsbad Municipal Water District Boundary

N

0 5,000 10,000 Feet

Figure 3.9
Potential Large Recycled Water Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 4/15/2011 FILENAME: c:\pw_working\projectwise\lwang\d0102644\Figure_3_8-Large_Potential_Customers.mxd

This page intentionally left blank.

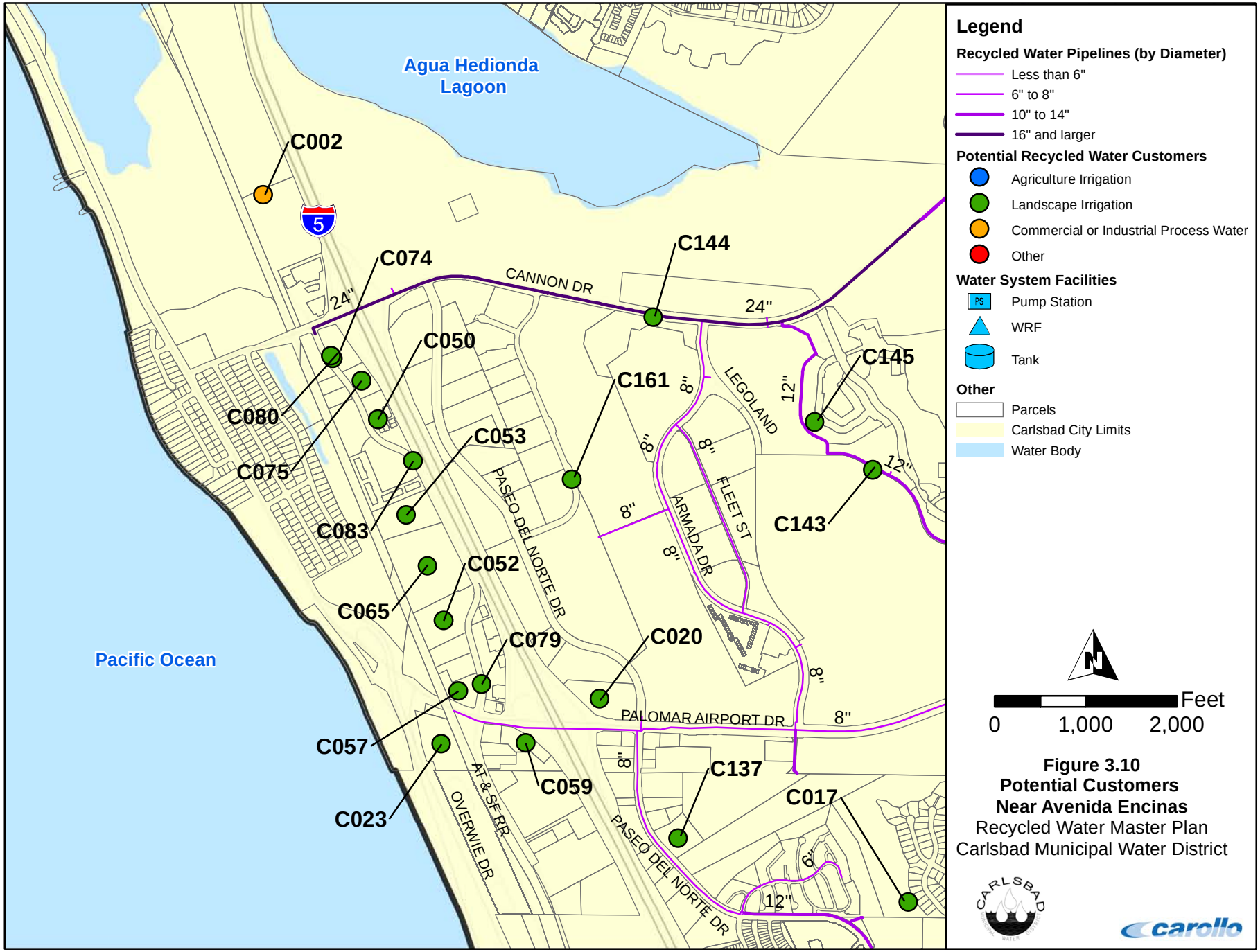


Figure 3.10
Potential Customers
Near Avenida Encinas
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 12/20/2010FILENAME: c:\pw_working\projectwise\lwang\d0102644\Figure_3_10-Potential_Customers_along_Avenida_Encinas.mxd

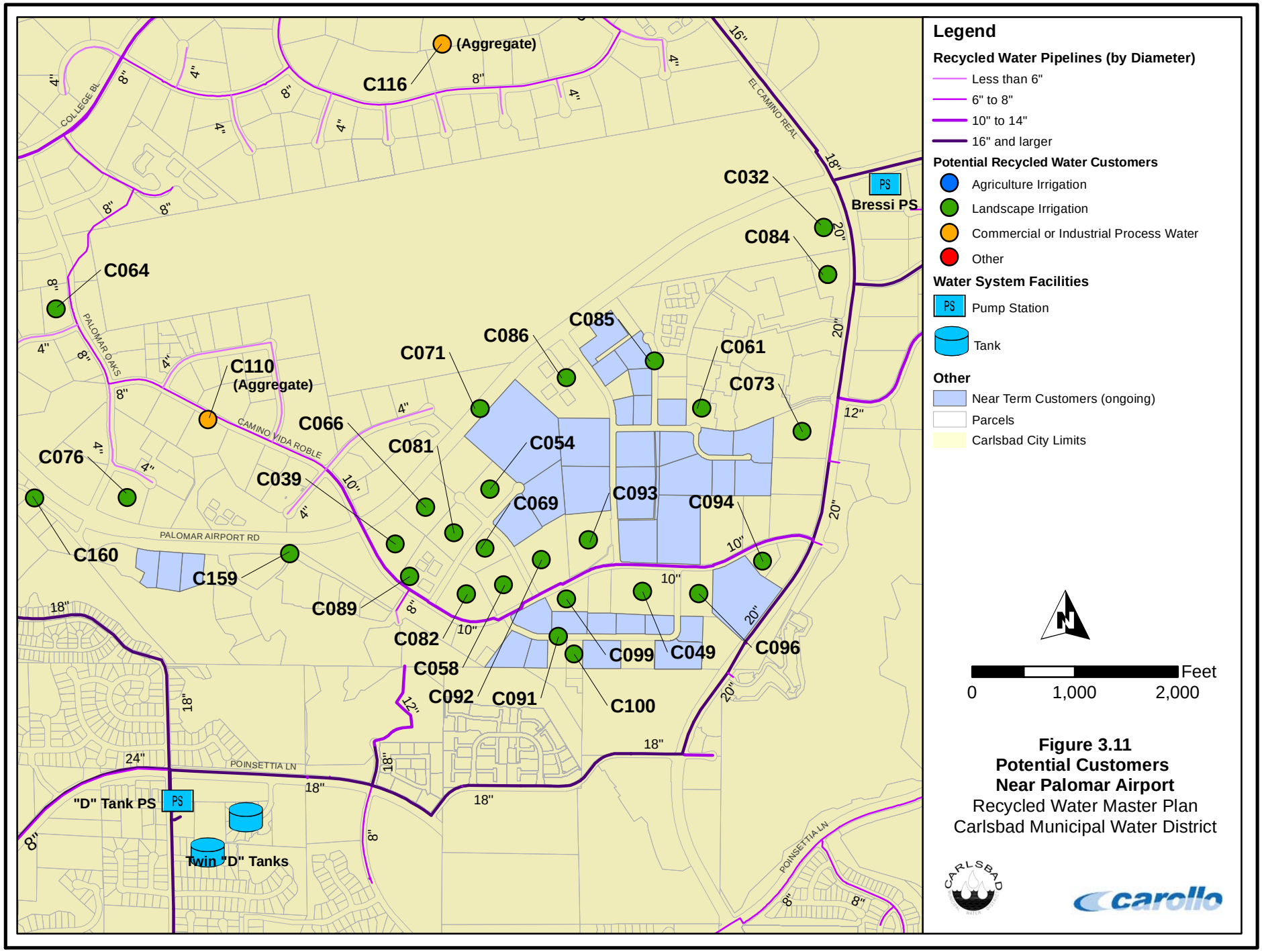


Figure 3.11
Potential Customers
Near Palomar Airport
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 4/15/2011 FILENAME: c:\pw_working\projectwise\lwang\d0102644\Figure_3_09-Potential_Customers_Near_Palomar_Airport.mxd

CMWD discussions with potential agricultural recycled water customers have indicated that the potential for recycled water usage may depend on the specific water quality requirements of each crop. It will also depend on the cost of the recycled water, and costs associated with developing a system suitable for irrigating the crops use. For 2010, the potable water demand for agriculture was 420 afy, which has steadily been declining since 1990.

The only existing agriculture customer using recycled water is the Flower Fields. Due to the cost of the recycled water, converting the remaining interim agriculture use is probably not cost effective and will not be counted on as potential customers in this study.

Commercial or Industrial Process Water

Industrial customers are sometimes the predominant application of recycled water in certain cities with large areas of commercial and industrial land use types. CMWD has some industrial water use at golf club manufacturing facilities, which currently use potable water. To convert these manufacturing facilities over to recycled water use, CMWD would need to interview the customer to determine their specific water quality needs to determine if recycled water is suitable. Many industrial or commercial processes already use pre-treatment systems for their process water; so in many cases, recycled water may be acceptable. In general, recycled water may be used in a commercial or industrial process if the recycled water is fully contained within the commercial or industrial process and the general public does not come in direct contact with the recycled water.

Only one potential industrial customer, NRG West Coast LLC, is included in the customer database. NRG West Coast LLC is considering expansion of its power plant. The power plant has expressed interest in using recycled water for industrial process water as well as landscape irrigation. NRG West Coast LLC provided estimates for water usage as well as daily peaking factors. Advanced treatment for the process water would be done on-site.

Usage of recycled water for cooling or air conditioning applications has not been used within CMWD's existing recycled water customer base, but could be a source of additional recycled water demands. Depending on the specific cooling system, advanced treatment may be necessary for cooling water applications to avoid corrosion and scaling within the cooling system. The customer database includes one specific customer that is currently interested in recycled water for cooling applications for a commercial office building (C013).

It is anticipated that additional cooling towers for commercial office buildings will be converted to recycled water in the future. In order to estimate the potential recycled water demand associated with conversion of commercial office building cooling towers, CMWD staff conducted a field investigation to determine the number of commercial office buildings with cooling towers and the total potable demand associated with these customers. These demands were grouped together for each of three large office parks in CMWD.

Based on a study conducted by the San Francisco Public Utilities Commission (SFPUC), a factor of 34 percent was applied to the total potable demand to approximate the component associated with HVAC equipment within office buildings. When using recycled water to replace potable water in cooling towers, the water use typically increases due to the increased TDS in recycled water. This is known as reduced concentrations or cycles. It was assumed that the increase in recycled water would be approximately 50 percent.

The resulting demands for each office park were reduced by 50 percent in order to account for customers that would be considered too small or impractical to serve. These demands are included in potential customers C110, C116, and C119.

Landscape Irrigation

HOAs, golf courses, resort properties, parks, schools, and other landscape irrigation are typically the most common customers in a recycled water system. These customers and their locations typically drive the layout of recycled water systems, and can be converted easily to recycled water use if separate plumbing for the irrigation lines exists (e.g., if potable water to restrooms and water fountains is fed by the same on-site pipelines as the sprinklers, a retrofit is much more difficult).

It should be noted that properties developed after 1991 were subject to CMWD's mandatory use ordinance (CMWD, 2005b) and were required to design irrigation systems for eventual recycled water connection, whether or not recycled water was available to the site.

The specific layout of certain HOAs limits the potential for recycled water conversion from potable irrigation systems, due to the separation requirements for irrigation. Discussions with CMWD staff highlighted specific HOAs for which conversion was anticipated to be impractical.

Parks are another preferred customer, as their large demand typically consists almost entirely of irrigation demands. These users can also be converted easily to recycled water use as long as irrigation lines are separated from other facilities at the park, such as restrooms.

School property often includes large fields, which are good candidates for conversion to recycled water. When the irrigation lines are separated from the school potable systems, these users can be converted easily to recycled water use.

Another type of landscape irrigation is commercial property irrigation. This usage type includes the irrigation of small business parks, apartment landscaping, and the landscaping surrounding commercial establishments. Typically, the demands for this use are small when compared to larger recycled water users such as parks and schools. However, CMWD has converted a large number of commercial irrigation users to recycled water by focusing efforts in business park areas.

Other

CMWD has identified one mobile home park with a set of ornamental lakes that is interested in recycled water to maintain the lake level (as the lake level declines due to evaporation). This demand is classified as Pond Evaporation.

Demands for this customer were categorized with the existing system Public Works (used for City utilities and the maintenance yard according to the 1997 RWMP [Carollo, 1997]) and Construction category as the category "Other". Although the Construction category is a temporary recycled water classification, it is assumed that future recycled water usage of this category will be consistent with 2010 usage to account for usage of future construction activities.

Neighboring Agencies

CMWD could potentially serve recycled water to customers of neighboring agencies located just outside CMWD's service area. These neighboring agencies are:

- Olivenhain Municipal Water District (OMWD)
- Vista Irrigation District (VID)
- Vallecitos Water District (VWD)
- City of Oceanside

OMWD has expressed interest in purchasing recycled water from CMWD at the southern border of CMWD's service area. Demand for this agency in the customer database is based on preliminary estimates discussed with OMWD staff to serve both OMWD's existing demands and future demands within OMWD's service area. It is anticipated that OMWD will provide storage for daily peaking within their distribution system at Wanket Reservoir, and be able to take water at a constant flow rate throughout the day. The Wanket Reservoir is currently a part of OMWD's potable water system, but is being investigated for potential conversion to recycled water. The Wanket Reservoir is 3 MG in capacity, about 30 feet high, and has a high water line (HWL) elevation of 427 ft-msl. As discussed in Chapter 4, OMWD currently supplies its system from the Meadowlark WRF. Based on Alternative 2A of the Northwest Quadrant Recycled Water Study (Boyle, 2004), the demand of OMWD's lower zones could be served from Gafner WRP. The study identified this based on supply from Gafner WRP, but delivery from CMWD's system could also apply. OMWD staff indicated demand in the lower zones of OMWD is anticipated to be 500 afy (0.4 mgd), while the anticipated growth in the upper zones is approximately 100 afy (0.1 mgd). The existing and future demand of 500 afy for the lower zones is included as an individual demand in the identified potential users; however, the 100 afy future demand for the upper zones is not included, since it is anticipated that OMWD will supply these demands from Meadowlark WRF.

VID's service area is located to the east of CMWD's service area, near Zones 580 and 660. One of CMWD's existing RW pipelines from Zone 660 crosses into VID's service area, which could potentially be used to connect new customers. The VID Water Reclamation Master Plan (CDM, 1993) identified 109 potential customers within its service area. As discussed in Chapter 4, the currently inactive Shadowridge Water Reclamation Facility is located within VID's service area and was originally intended to supply the Shadowridge Golf Course with recycled water for irrigation. As the market assessment included in the 1993 Water Reclamation Master Plan was performed over a decade ago, the aerial photograph and the City's GIS layer of parks and schools were used to identify eight potential customers, which were added to the customer database. One of these customer database entries is an aggregate demand for a business park that represents approximately 15 customers from the Water Reclamation Master Plan. CMWD obtained potable water use records for customers within the VID boundary for verification of demand projections.

VWD supplies CMWD and OMWD with recycled water, however, it does not retail recycled water to customers within its service area. The 2002 VWD Water, Wastewater, and Water Reclamation Master Plan Update (KJ, 2005) concluded that the demands from the potential customers it identified were not sufficient to construct a distribution system to retail recycled water, recommending instead to continue wholesaling the entire supply from Meadowlark WRF to CMWD and OMWD. Using the aerial, as well as the schools and park GIS layer provided by the City, six customers were added to the customer database within the VWD service area. Two additional potential customers were added to the customer database based on discussions with CMWD staff.

The City of Oceanside is located to the north of CMWD's service area. The VID Water Reclamation Master Plan identified an additional 26 customers located within the City of Oceanside near the VID service area. Potential customers were also identified from the City's GIS layer of parks and schools, which extends into the City of Oceanside. The Ocean Hills golf course was identified from the aerial photograph. A total of six potential customers were added to the customer database. While the VID Water Reclamation Master Plan mentioned that the City of Oceanside was considering producing recycled water at its San Luis Rey Wastewater Reclamation Facility (SLRWRF), no master reclamation permits have been issued by the regional water quality control board for the City of Oceanside at this time. The SLRWRF maintains a small recycled water treatment facility. The reclamation facility has a rated capacity of 0.7 mgd, but typically provides about 0.5 mgd to the Oceanside Municipal Golf Course and nearby Whelan Lake. The City of Oceanside has plans to construct a new reclamation facility at SLRWRF with a rated capacity of 1.5 mgd. The additional recycled water will be used at the SLRWRF for plant water and irrigation purposes. The new facility is master planned to allow phased expansion up to 7.5 mgd. Implementation of additional phases will depend on customer demands and the cost of potable water. Identified users for the SLRWRF recycled water are located in northern Oceanside.

3.5.3 Near Term Demands

CMWD is presently working on connecting additional customers to the existing recycled water system. The locations of these “Near Term” customers were identified by CMWD staff and include 25 retrofit sites for an estimated total demand of 50 afy and about 25 new construction sites on remaining vacant industrial sites in Carlsbad Research Center, Bressi Ranch, and Carlsbad Oaks North. The total of these customers is estimated to be an additional 50 afy. This demand of 100 afy (0.1 mgd) was included as a “Near Term” demand in addition to the identified potential and existing demands.

3.5.4 Summary of Potential Customers

Figure 3.9 shows locations for the potential customers identified in the customer database and Table 3.6 summarizes the aggregate demands for these potential customers by category and sub-category, while a detailed description of each potential customer is included in Appendix C.

As shown in Table 3.6, the total additional potential future demand within CMWD’s service area is approximately 2,711 afy (2.4 mgd). This demand includes 711 afy (0.6 mgd) for the NRG power plant listed as C002 in Industrial in Table 3.6. The potential demand without the NRG power plant would be 2,000 afy (1.8 mgd). In addition, 2,657 afy (2.4 mgd) of demands were identified in the service areas of neighboring agencies for a total of 5,368 afy (4.8 mgd).

The demands identified in Table 3.6 include all potential users for which detailed information is known, but does not include areas anticipated for eventual development not associated with specific developments (which will be discussed later). This market assessment is intended to determine all potential customers, while the determination of whether a customer should be connected will be discussed in Chapter 9.

Table 3.6 Customer Demand by Category
Recycled Water Master Plan
Carlsbad Municipal Water District

Customer Category[1]	Existing System Demand[2] (afy) 2009	2010	Near Term Demand (afy)	Potential Future Demand[3] (afy)
Agricultural Irrigation	0	23	0	0
Commercial or Industrial Process Water				0
Industrial	0	0	0	711
Commercial Cooling	0	0	0	62
Landscape Irrigation[4]				
Commercial Property Irrigation	1,074	637	100	645
Community Facilities	27	49	0	0
Golf Courses	1,133	1,033	0	50
Highways	25	11	0	0
HOA	1,469	1,369	0	885
Resort Property Irrigation	340	195	0	75
Parks	195	69	0	147
Schools	85	91	0	131
Other				0
Construction	2	0	0	0
Pond Evaporation	0	0	0	5
Public Works	0	40	0	0
Subtotal inside Service Area	***4,350***	***3,517***	***100***	***2,711***
Neighboring Agencies[5]				
Olivenhain Municipal Water District[4]	0	0	0	687
Vista Irrigation District	0	0	0	1,158
Vallecitos Water District	0	0	0	557
City of Oceanside	0	0	0	255
Subtotal outside Service Area	***0***	***0***	***0***	***2,657***
Total	**4,350**	**3,517**	**100**	**5,368**

Notes:
(1) Details by customer are presented in Appendix C.
(2) Average Existing Demand is shown for calendar years 2009 and 2010. An existing system demand of 4,000 afy is assumed for this study and will be used in later analysis of this chapter. However, demand for years 2009 and 2010 are shown here to show the demand by customer category.
(3) Potential Future Demand from Customer Database (see Appendix C and Table 3.7). Does not include demands for New Developments (areas which are anticipated to eventually develop but without definite plans for development at this time).
(4) Landscape Irrigation is divided into 8 sub-categories. For the 500 afy OMWD demand, the breakdown of demands into sub-categories was not available, but the individual customers making up the 500 afy are anticipated to fall within the landscape irrigation category.
(5) Potential demand identified in neighboring agencies of City of Oceanside, OMWD, VID, and VWD.

The demand estimates and usage type classifications of the 161 identified potential customers are listed in Table 3.7, while their locations are presented on Figure 3.9, Figure 3.10, and Figure 3.11.

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C002	NRC West Coast LLC / Cabrillo Power	711.0	Industrial	Y
C004[2]	KSL Resorts: La Costa Resort (Group)	20.0	Resort Property Irrigation	Y
C005	Robertson's Ranch - West Village (Phase 2)	118.3	HOA	Y
C008[2]	Rancho Carlsbad MHP	35.0	HOA	Y
C009	Robertson's Ranch - East Village (Phase 1)	65.8	HOA	Y
C010	Tamarack Point HOA	42.0	HOA	Y
C012	Rancho Carlsbad Golf Course (Executive Course)	50.3	Golf Courses	Y
C013	Invitrogen (Life Technologies)	18.0	Commercial Cooling	Y
C014	San Pacifico HOA	41.5	HOA	Y
C017[2]	Alta Mira HOA	13.0	HOA	Y
C018[2]	Valley Middle School (Carlsbad Unified School)	17.0	Schools	Y
C020	Carlsbad Property Inc (Group)	19.7	Commercial Property Irrigation	Y
C021	Pan Pacific Retail Prop Inc	19.5	Commercial Property Irrigation	Y
C023	William L Canepa	8.0	Resort Property Irrigation	Y
C025[2]	Army and Navy Academy (includes Maxton Brown Park)	17.8	Schools	Y
C026[2]	Camino Hills HOA	17.8	HOA	Y
C027	Full Range Prty LLC (Carlsbad Golf Center)	17.5	Commercial Property Irrigation	Y
C028[2]	The Village Apartments	8.7	Commercial Property Irrigation	Y
C029[2]	Plaza Camino Real	25.6	Commercial Property Irrigation	Y
C032	OVLC Management Co. DBA / KSL (was Olympic Hotel / PAC)	15.0	Commercial Property Irrigation	Y

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C033	Motel 6 - Site 000471	14.9	Commercial Property Irrigation	Y
C034	City of Carlsbad Parks	14.9	Parks	Y
C035	Senior Center Field (City of Carlsbad Parks)	3.4	Commercial Property Irrigation	Y
C037[2]	Hope Elementary School (Group)	13.3	Schools	Y
C038	Ponto Hotel	13.0	Resort Property Irrigation	Y
C039	Palomar Triad #520	12.8	Commercial Property Irrigation	Y
C040[2]	Kelly Elementary School (Group)	10.5	Schools	Y
C041[2]	Carlsbad High School (Group)	10.1	Schools	Y
C043	Brierly Field (City of Carlsbad Parks)	9.6	Parks	Y
C044[2]	Existing Landscape Meters near Impala Dr and Palmer Wy	31.0	Commercial Property Irrigation	Y
C045	Holiday Park (City of Carlsbad Parks)	9.3	Parks	Y
C046	Holiday Park (City of Carlsbad Parks)	8.5	Parks	Y
C047	Chase Field (City of Carlsbad Parks)	8.3	Parks	Y
C049	Equity Growth Invest	7.9	Commercial Property Irrigation	Y
C050	Carlsbad Commercial Center	7.8	Commercial Property Irrigation	Y
C051	City of Carlsbad Parks	7.3	Schools	Y
C052	Carlsbad Point Corporation	7.0	Commercial Property Irrigation	Y
C053	Gildred Development	6.8	Commercial Property Irrigation	Y
C054	2052 CDN LLC	6.8	Commercial Property Irrigation	Y
C055	North Pointe HOA	1.5	HOA	Y
C056[2]	Greenview HOA	6.4	HOA	Y
C057	Cognac Pacific Corporate LLC	6.4	Commercial Property Irrigation	Y

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C058	H G Fenton	6.1	Commercial Property Irrigation	Y
C059	Cognac Carlsbad Pac Centr LLC	6.1	Commercial Property Irrigation	Y
C060[2]	Buena Vista Elementary School (Group)	2.0	Schools	Y
C061	North Pointe HOA	6.0	HOA	Y
C062	Viaggio HOA and Aviara Masters HOA	9.2	HOA	Y
C063	City of Carlsbad Parks	5.7	Parks	N
C064	Future Parcel - Carlsbad Airport Center	1.8	Commercial Property Irrigation	Y
C065	Windstar Carlsbad Office LLC / Floral Trade Center	5.5	Commercial Property Irrigation	Y
C066	Public Storage Inc	5.3	Commercial Property Irrigation	Y
C067[2]	Magnolia Elementary School (Carlsbad Unified School)	3.1	Schools	Y
C068[2]	Dolphin Beach Apartments	1.0	HOA	Y
C069	Kilwa Manufacturing Inc	5.2	Commercial Property Irrigation	Y
C070	Jefferson Elementary School Irrigation (City of Carlsbad Parks)	5.1	Schools	Y
C071	Realty Associates Fund VII LP	5.1	Commercial Property Irrigation	N
C072[2]	Lakeshore Gardens MHP (Group)	5.0	Pond Evaporation	Y
C073	Naturemaker Inc	5.0	Commercial Property Irrigation	Y
C074	Inns of America Suites	5.0	Commercial Property Irrigation	Y
C075	Cognac Carlsbad Pacifica LLC	5.0	Commercial Property Irrigation	Y
C076	Future Parcel - Carlsbad Airport Center	2.6	Commercial Property Irrigation	Y
C078	City of Carlsbad Parks	4.6	Parks	Y

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C079	Palomar and Company	4.4	Commercial Property Irrigation	Y
C080	Inns of America Suites	4.4	Commercial Property Irrigation	Y
C081	Bond Ranch	4.3	Commercial Property Irrigation	Y
C082	Boi Carlsbad Inc	4.2	Commercial Property Irrigation	Y
C083	CBRE Carlsbad Commercial Ctr	4.2	Commercial Property Irrigation	Y
C084	North Pointe Owners' Assoc	2.0	HOA	Y
C085	Palomar Lot 10 BCA	4.0	Commercial Property Irrigation	Y
C086	Realty Associates Fund VII LP	4.0	Commercial Property Irrigation	Y
C087	Tramanto HOA	3.8	HOA	Y
C089	Carlsbad Corporate Center	3.5	Commercial Property Irrigation	Y
C090	Bressi Ranch Corp Ctr	3.4	HOA	Y
C091	Spy Optic Inc	3.4	Commercial Property Irrigation	Y
C092	Del Abeto Cntr #260	3.1	Commercial Property Irrigation	Y
C093	Palomar 910 Assoc Ltd	2.6	Commercial Property Irrigation	Y
C094	Guy Freeborn	2.5	Commercial Property Irrigation	Y
C096	Micro-Probe Prop LLC	2.4	Commercial Property Irrigation	Y
C099	CBRE - Josepho Family Trust	1.1	Commercial Property Irrigation	Y
C100	Sierra Land Group Inc	0.9	Commercial Property Irrigation	Y
C104	Hosp Grove Park	2.0	Parks	Y
C107	Alga Norte Park (Future)	71.9	Parks	Y
C109[2]	Future High School Site	30.0	Schools	Y
C110	Business Park Cooling Towers in Carlsbad Airport Center	9.9	Commercial Cooling	Y

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C116	Business Park Cooling Towers in Carlsbad Research Center	30.0	Commercial Cooling	Y
C119	Business Park Cooling Towers in Carlsbad Oaks	4.4	Commercial Cooling	Y
C126	High-Density Residential Development at Quarry Creek	64.5	HOA	Y
C132	Rotary Park	2.2	Parks	Y
C135	Magee Park	4.6	Parks	Y
C137	Discovery Isle Child Development	3.6	Schools	Y
C140	Irrigation Meters in Palisades and Telescope HOA	11.7	HOA	Y
C141	Beythlechim	0.6	Schools	N
C143	Legoland Inner Park Expansion	33.6	Resort Property Irrigation	Y
C144	Gemological Institute of America Expansion	5.2	Commercial Property Irrigation	Y
C145	Carlsbad Ranch Resort	37.9	Commercial Property Irrigation	Y
C146[2]	Dos Colinas (Senior Independent and Assisted Care Living)	59.7	HOA	Y
C147	Walmart / Sunny Creek Plaza	12.0	Commercial Property Irrigation	Y
C148	Cantarini	115.0	HOA	Y
C149	Holly Springs	93.1	HOA	Y
C150	Carlsbad Oaks North - Phase I	42.1	Commercial Property Irrigation	Y
C151	Carlsbad Oaks North - Phase II	34.0	Commercial Property Irrigation	Y
C152	Carlsbad Oaks North - Phase III	36.3	Commercial Property Irrigation	Y
C153	Bressi Ranch - Planning Areas 1 through 4	43.5	Commercial Property Irrigation	Y
C154	Bressi Ranch - Planning Area 5	9.9	Commercial Property Irrigation	Y
C155	Bressi Ranch - Planning Area 15	10.4	Commercial Property Irrigation	Y

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C156	Rancho Carrillo Village H - Palomar Korean Church	2.4	Commercial Property Irrigation	Y
C157	Carlsbad Raceway and Palomar Forum - Remaining Vacant Parcels	44.6	Commercial Property Irrigation	Y
C158	HOA	11.1	HOA	Y
C159	Existing Landscape Meters along Palomar Oaks Way	15.7	Commercial Property Irrigation	Y
C160	Future Business Park Irrigation along Palomar Oaks	8.0	Commercial Property Irrigation	Y
C161	Existing Landscape Meters along Car Country Drive	12.0	Commercial Property Irrigation	Y
C162	Existing Landscape Meters along Frost Avenue	8.0	HOA	Y
C163	Existing Colony at Calavera Irrigation Meters	7.2	HOA	Y
C164	Existing Landscape Meters along El Camino Real	2.0	HOA	Y
C165	Existing Landscape Meters at Marbella (Apartment Complex)	2.0	HOA	Y
C166	Existing Landscape Meters at Marea	8.6	HOA	Y
C167	Existing Landscape Meters along Blue Orchid Lane	9.7	HOA	Y
C168	Existing Landscape Meters at Alga Hills HOA	17.2	HOA	Y
C169	Existing Landscape Meters at Jockey Club HOA	15.8	HOA	Y
C170	Existing Landscape Meters along Altisma Way	4.0	HOA	Y
C171	Existing Landscape Meters at Alicante Hills HOA	14.4	HOA	Y
C172	Existing Landscape Meters along Navigator Circle	3.4	HOA	Y
C173	Library and Civic Center (City of Carlsbad Library and Parks)	5.0	Parks	Y
C174	Existing Landscape Meters at HOAs on Chinquapin Ave	24.0	HOA	Y

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C175	Existing Landscape Meters along Oak Avenue	3.5	Commercial Property Irrigation	Y
C176	Carlsbad Village Academy	11.0	Schools	Y
C177	Existing Landscape Meter at Avenida Encinas	14.9	Commercial Property Irrigation	Y
C178	Existing Landscape Meters at The Villa HOA	20.0	HOA	Y
C179	Existing Landscape Meters at Fairways HOA	26.8	HOA	Y
Subtotal - Inside CMWD Service Area		***2,711.0***		
C001	OMWD Customers (Gafner WRP or from Carlsbad WRF via El Camino)	500.0	Landscape Irrigation	Y
C108	La Costa Canyon High	63.9	Schools	N
C118	Future School	31.4	Schools	N
C120	La Costa Canyon Park	27.5	Parks	N
C122	La Costa Heights Elementary/Levante Park	20.8	Parks	N
C127	El Camino Creek Elementary	11.4	Schools	N
C128	Olivenhain Pioneer Elementary	11.4	Schools	N
C130	Mission Estancia Elementary	10.1	Schools	N
C131	Cadencia Park	9.7	Parks	N
C142	La Costa Valley Preschool and Kindergarten	0.5	Schools	N
Subtotal - OMWD		***686.7***		
C003	Shadowridge Golf Course	448.1	Golf Courses	Y
C101	Business Park (Vista Irrigation District)	582.3	Commercial Property Irrigation	Y
C111	Buena Vista Park	53.5	Parks	Y
C114	Rancho Buena Vista High	39.2	Schools	Y
C125	Center for Science/Math/Technology	12.3	Schools	N
C129	Breeze Hill Park	10.9	Parks	Y
C134	Breeze Hill Elementary	7.9	Schools	Y
C136	Tri City Christian Schools	3.7	Schools	N
Subtotal - VID		***1,157.9***		

Table 3.7 Potential Customers
Recycled Water Master Plan
Carlsbad Municipal Water District

Map ID[1]	Customer Name	AAD (afy)	Customer Type	Included in Ultimate System[3]
C042	La Costa Meadows Elementary School	9.7	Schools	Y
C088	St. Elizabeth Seton Church	1.8	Schools	Y
C102	Lake San Marcos Resort Country Club	336.0	Golf Courses	N
C105	Lake San Marcos Executive Golf Course	99.9	Golf Courses	N
C112	Business Park (Vallecitos Water District)	42.7	Commercial Property Irrigation	Y
C113	Park	39.7	Parks	Y
C123	San Marcos High School	19.2	Schools	N
C133	Fuerte Park	8.2	Parks	Y
Subtotal - VWD		***557.2***		
C103	Ocean Hills Country Club	148.0	Golf Courses	Y
C115	Oak Riparian Park	36.5	Parks	N
C117	Madison Middle/Lake Elementary	33.6	Schools	Y
C121	Lake Park	22.4	Parks	Y
C124	New Venture Christian Schools	13.4	Schools	Y
C139	Montessori of Oceanside	0.9	Schools	Y
Subtotal - City of Oceanside		***254.8***		
Subtotal - Outside CMWD Service Area		***2,656.6***		
Grand Total		**5,367.6**		

Notes:
(1) Map IDs correlate to the site number in Figure 3.9.
(2) Cross-connection testing requirements may prevent full conversion of this site to recycled water.
(3) Indicates whether customer was determined to be feasible for connection to the potential expansion segments as discussed in Chapter 9.

The distribution of demands relative to service area is shown on Figure 3.12. This figure illustrates that about 50 percent of the potential future demand is located within CMWD's service area while the remaining 50 percent is distributed within neighboring agencies.

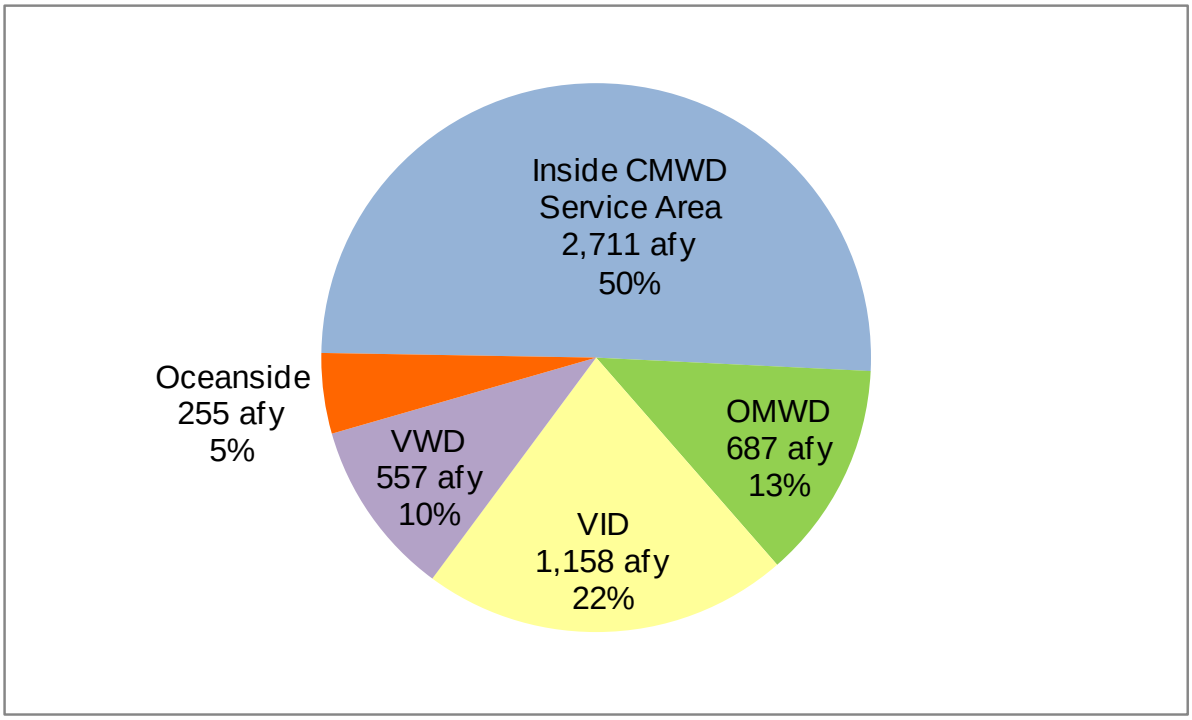


Figure 3.12 Distribution of Potential Demands by Service Area

3.5.5 Customer Questionnaire

Customer surveys were developed and sent to several of the largest potential customers identified in the customer workshop. These questionnaires requested information about any barriers the customers had to using recycled water.

The majority of the mailed customer questionnaires did not successfully reach the potential customers due to a discrepancy between the service address and billing addresses. However, in general, results of the survey showed that customers were interested in recycled water. Several customers mentioned that financing of recycled water conversion would be the primary barrier to adopting recycled water. To date, CMWD has not assisted in financing of customer site conversions, and has no plans for participating in financing of conversions in the future. Overall, the responses that were received did not indicate hostility toward the usage of recycled water.

3.5.6 Smaller Pickup Customers

Identifying potential customers beyond the 161 potential users included in the customer database is not anticipated to be viable. An additional 144 customers were identified with historical potable water billing records totaling approximately 55 afy (less than 0.1 mgd). However, the demand of these additional 144 customers is relatively low demand when compared to the top 161 potential customers listed in the customer database. The steep decline in demand by customer is also illustrated on Figure 3.13.

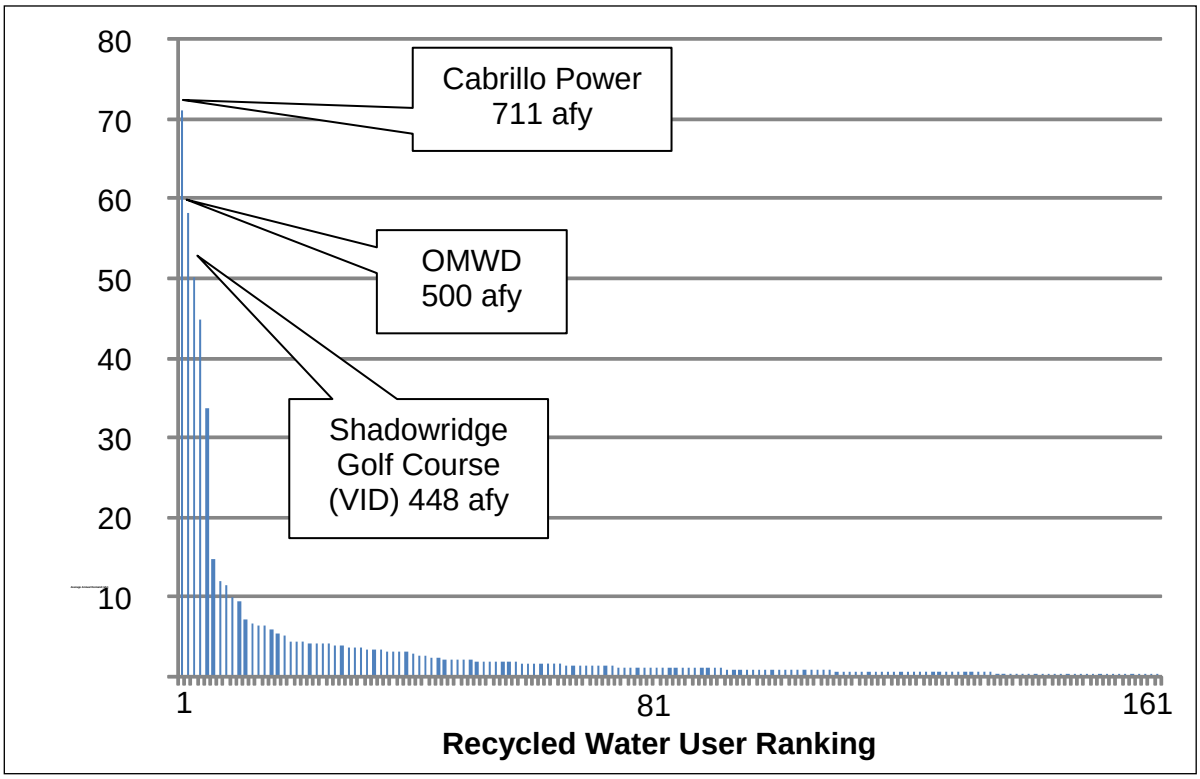


Figure 3.13 Large User Demand Ranking Effect

As shown in Figure 3.13, the demand of each individual potential customer drops off significantly after the first few large customers. Because of this drop off effect, recycled water demands for the 144 potential customers ranking past the top 161 were not included in this study. CMWD has worked extensively to identify potential customers for conversion near the existing system and it is assumed this effort will continue in the future.

3.5.7 Demand Factors

For new developments or customers without historical billing records, demand factors were developed to estimate potential demand based on historical demand records and areas of known developments.

Demand factors were developed for irrigation associated with HOAs, commercial and industrial properties, golf courses, schools, and parks. Demand factors were not developed for other uses since City planning documents did not indicate other large planned developments with other uses. It is assumed that future development of planned communities (with HOA demands) and business parks (commercial and industrial irrigation) will be similar in irrigation practices to recent developments. Some areas of typical recent development were selected for each of these categories to develop the recycled water demand factors. These water demand factors are presented in Table 3.8.

Table 3.8 Water Demand Factors
Recycled Water Master Plan
Carlsbad Municipal Water District

Usage Type	Description	Water Demand Factor (gpd/ac)
HOAs	Includes irrigation of street medians and common areas of HOAs	700
Business Park	Landscape irrigation for commercial and industrial properties	600
School	Irrigation of fields and landscaping of schools	1,000
Park	Irrigation of parks	2,000
Golf Course	Irrigation for golf courses	2,500

Note:
(1) Water Demand Factors are applied to the parcel acreage, and thus exclude streets.

It should be noted that recycled water use within HOAs is primarily within common areas and street medians. While residential planned communities can use recycled water for irrigation of individual homes, the cross-connection testing requirements render irrigation of individual homes with recycled water infeasible.

It should also be noted that the typical commercial and industrial properties and business parks consists of very little irrigated area. Based on aerial imagery, typical lots may consist of about 10 percent irrigated landscaping. It is assumed that future commercial property development will use irrigation in a similar manner as existing commercial properties.

3.5.8 New Developments

New developments present a unique opportunity for recycled water use, as the location and installation of recycled water distribution infrastructure can be implemented during initial construction of the development, resulting in shorter construction time and lower cost compared to construction in existing developments where pavement repair and traffic control would be required.

The City's Planning Department provided a list of parcels with anticipated development. This list was joined to the City's GIS parcel layer. Subsequently, the Planning Department's classifications were adapted to recycled water usage designations as follows:

- Residential parcels (Multiple Family [MF], Single Family [SF], and Septic) were assigned to the HOA category if the parcels fell within tracts of land suitable for planned community development. Isolated individual residential parcels less than 5 acres in size were not considered suitable for recycled water irrigation.
- Commercial and Industrial parcels were assigned to the Commercial and Industrial Property Irrigation category.

The data provided by the planning department focused on detailed development over the next five years, but in most cases, development past five years was assumed to increase linearly across the years within the planning period.

Where information on detailed development was available, the relevant parcels were added to the customer database. These parcels are shown in brown on Figure 3.14. The remaining development areas were categorized into either Residential (consisting of HOA type development) or Commercial Irrigation (consisting primarily of commercial and business park irrigation) and the corresponding demand factors were applied to estimate a total future demand due to development. Since CMWD has focused its conversion efforts on developments that are able to adequately take advantage of recycled water, it is anticipated that not every development can fully utilize recycled water to the same extent. Thus, the total future demand due to new developments was reduced by 50 percent.

The areas are shown in Figure 3.14 and the demand is summarized in Table 3.9.

Table 3.9 New Development Demand Projections
Recycled Water Master Plan
Carlsbad Municipal Water District

Land Use Type	Total Acreage (Parcels >5 ac)	Demand Factor (gpd/ac)	Total Future Demand (gpd)	Total Future Demand (afy)
Residential	615	700	430,500	482
Commercial Irrigation	306	600	183,600	206
Subtotal	***921***	***N/A***	***614,100***	***688***
50% Reduction	N/A	N/A	-307,050	-344
Total			**307,050**	**344**

Oceanside
Marron Rd
78
Buena Vista Lagoon
Elm Ave
Highland Dr
Camino Real
Tamarack Ave
Carlsbad Blvd
Lake Calavera
Calavera PS
"C" Tank
Oceanside
Shadowridge WRP
Vista
Alondra Way
Agua Hedionda Lagoon
5
Cannon Rd
College Blvd
San Marcos
Palomar Airport RD
Bressi PS
El Fuerte St
Pacific Ocean
Carlsbad WRF
"D" Tank PS
Twin "D" Tanks
Paseo Norte
Poinsettia Ln
Aviara Pkwy
Meadowlark WRF
Mahr Reservoir
Batiquitos Lagoon
Costa Ave
Gafner WRP
Rancho Santa Fe
Calle Barcelona
Encinitas
Encinitas

Legend

Recycled Water Pipelines (by Diameter)
- Less than 6"
- 6" to 8"
- 10" to 14"
- 16" and larger

Recycled Water Facilities
- Pump Station
- Pressure Regulation Station (PRS)
- WRF
- Tank
- Reservoir
- Inactive WRP

New Developments
- Residential
- Commercial Irrigation
- Development not anticipated to utilize Recycled Water (Small Parcels)
- Represented in Customer Database

Others
- Freeways
- Major Roads
- Local Streets
- City Boundary
- Carlsbad City Limits
- San Diego County
- Water Body
- Carlsbad Municipal Water District

N

0 5,000 10,000 Feet

Figure 3.14
Areas of New Developments
Recycled Water Master Plan
Carlsbad Municipal Water District

DATE: 4/15/2011 FILENAME: c:\pw_working\projectwise\wang\d0102644\Figure_3_13-Incorporating Recycled Water.mxd

This page intentionally left blank.

3.5.9 Demand Summary

The total potential demand for the ultimate system is projected by combining the existing demand, the near-term demand, the demand from the potential customer database (inside and outside CMWD's service area), and the demand from new developments. Table 3.10 presents a summary of demand projections while Figure 3.15 graphically shows the build out demand by customer category.

Table 3.10 Summary of Demand Projections
Recycled Water Master Plan
Carlsbad Municipal Water District

Customer Category	Demand (afy)	Source
Existing	4,000	End of Section 3.3.2
Near-Term	100	Table 3.6
Customer Database (in Service Area)	2,711	Table 3.6
Neighboring Agencies	2,657	Table 3.6
New Developments	344	Table 3.9
Potential Total Demand	**9,812**	

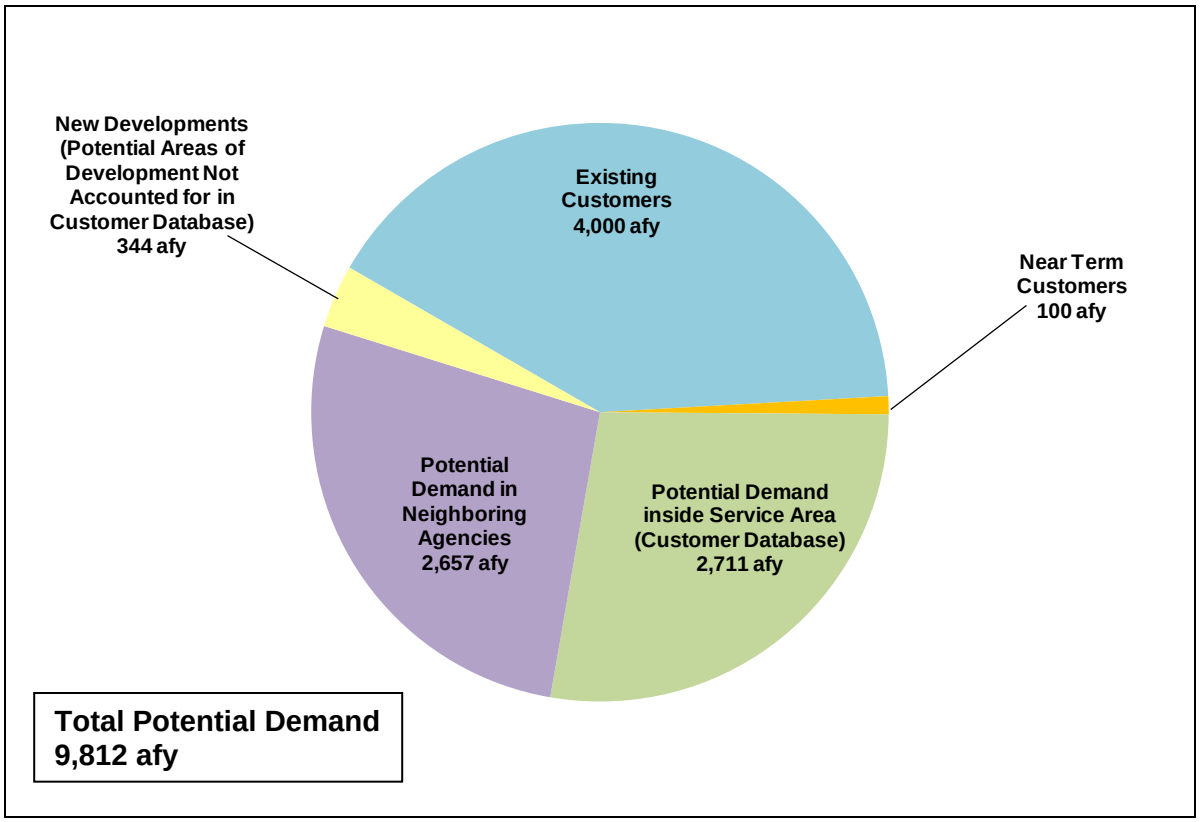


Figure 3.15 Potential Build Out Demand Summary

As shown in Table 3.10, the potential build out demand is estimated to be approximately 9,812 afy (8.3 mgd).

The feasibility of serving this potential build out demand is evaluated in Chapter 9, Future System Analysis, which includes an analysis of the various pipeline alignments required to serve this total potential demand. The results of this analysis are used to prioritize pipeline extension projects and determine the build out demand that is considered for the Capital Improvement Program (CIP) projects presented in Chapter 10 of this master plan.

A summary of customers by location in relation to the service area is presented in Table 3.11.

Table 3.11 Potential Build Out by Service Area
Recycled Water Master Plan
Carlsbad Municipal Water District

Category	Demand Inside Service Area (afy)	Demand Outside Service Area (afy)	Total Demand (afy)
Existing	4,000	0	4,000
Near Term / In Progress	100	0	0
Potential Future Demand[(1)]	2,711	2,657	5,368
New Developments[(2)]	344	0	344
Total	**7,155**	**2,657**	**9,812**
Percentage	**73%**	**27%**	**100%**

Note:
(1) Customers identified within the customer database (Appendix C). Customers with a Purveyor of OMWD, VID, VWD, or Oceanside are outside CMWD's service area.
(2) Additional development not individually identified which did not have specific information on timing. Included to adequately size pipelines for ultimate build out conditions.

As shown in Table 3.11, the potential build out demand includes approximately 2,657 afy or 27 percent of recycled water demand from customers that are located outside CMWD's service area.

CMWD should consider adopting a goal for maximizing the cost effective use of recycled water within its service area. Currently, recycled water use accounts for almost 20 percent of the aggregate water within CMWD. As shown in Table 3.12, if all potential demands within CMWD are connected, CMWD will meet a recycled water use goal of approximately 27 percent by the year 2020. The demand projections for the year 2020 are based upon a 2020 potable water demand of 25,100 afy from CMWD's 2010 Urban Water Management Plan (UWMP). It should be noted that the development assumptions in the UWMP may not have assumed the same development shown in Figure 3.14.

Table 3.12 Percentage of CMWD Demand Identified
Recycled Water Master Plan
Carlsbad Municipal Water District

Potable Demand Projection Year 2020[(1)] (afy)	Potential RW Demand[(2)] (afy)	Total Demand Year 2020 (afy)	Maximum Percentage Recycled Water by Year 2020[(3)]
25,100	6,811	31,911	27%

Notes:
(1) Source: CMWD's 2010 UWMP (CMWD, 2010).
(2) Demand Inside Service Area based on demands from Table 3.11, deducting New Developments as not likely to be in place by 2020.
(3) If all Potential RW Demands except New Developments were realized by 2020.

Chapter 9 discusses the specific customers that could be connected to expansion segments of the future recycled water system, and which potential customers were not able to be connected to expansion segments in a cost-effective manner. Table 3.13 presents a summary of the demands included in the ultimate recycled water system based on the discussion in Chapter 9. As shown, the build-out system includes a total of 7,144 afy (6.4 mgd) considering only the demand within CMWD's service area and, totaling 9,106 afy (8.1 mgd) including demands from neighboring agencies.

Table 3.13 Build-out Demand Summary
Recycled Water Master Plan Update
Carlsbad Municipal Water District

Demand Description	AAD (afy)	AAD (mgd)	MMD (mgd)
Existing + Near-Term (Phases I and II)	4,100	3.7	6.2
Potential Customers within CMWD	2,711	2.4	4.1
New Developments (with indefinite timing)	344	0.3	0.5
Total Identified Demand within CMWD	**7,155**	**6.4**	**10.9**
Not Feasible inside Service Area	-11	< 0.1	< 0.1
Total for CMWD Build-out System	**7,144**	**6.4**	**10.8**
Potential Customers outside CMWD	2,657	2.4	3.7
Not Feasible outside Service Area	-695	-0.6	-1.1
Total for Build-out System with Neighboring Agencies	**9,106**	**8.1**	**13.5**

This page intentionally left blank.